ELECTRICAL TIMES

THURSDAY
15 JAN.
1953
NINEPENCE

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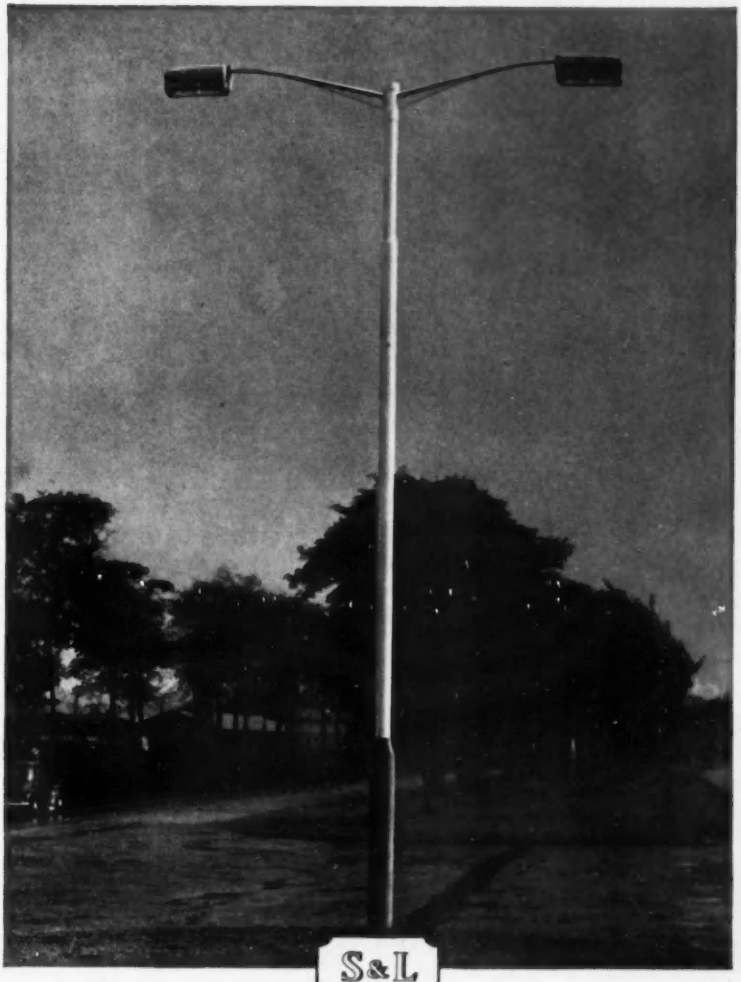

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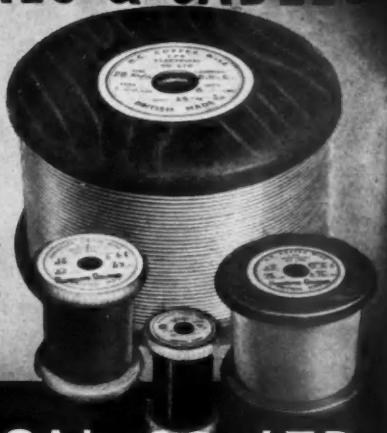

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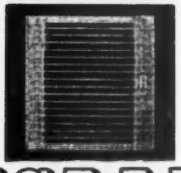

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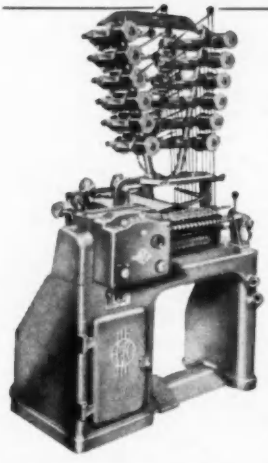

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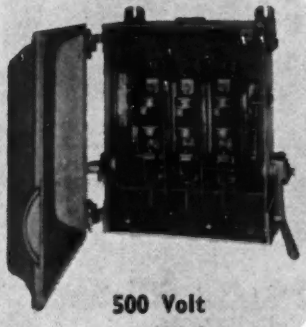

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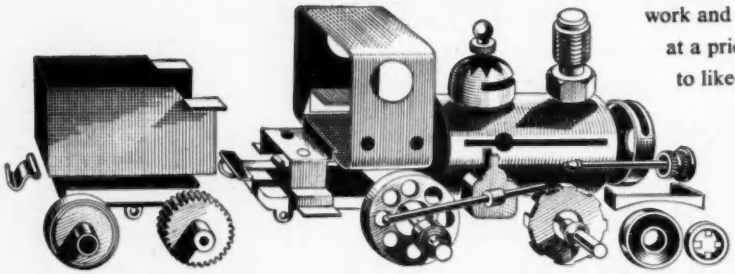

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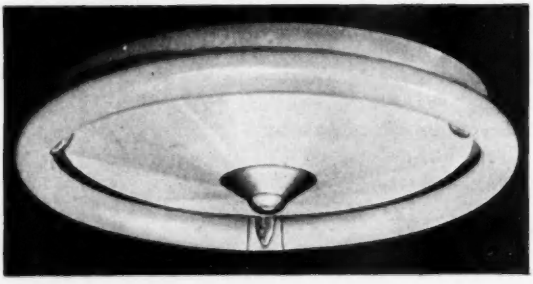

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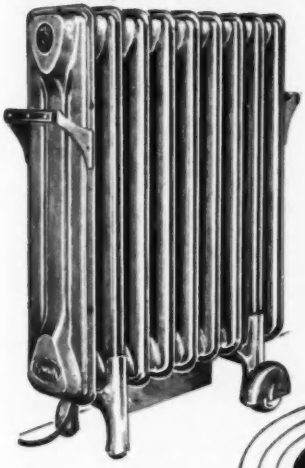

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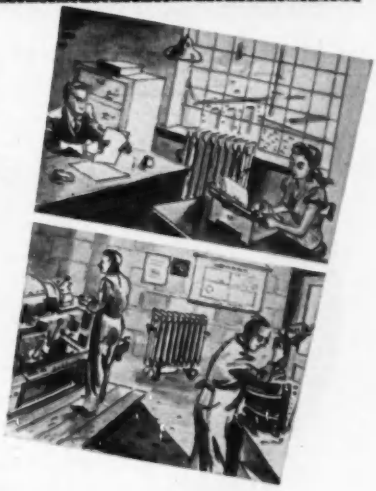

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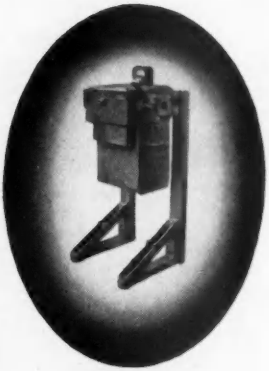

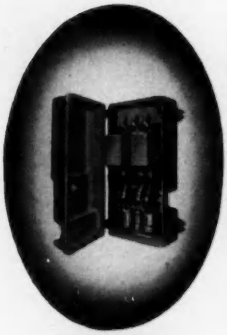

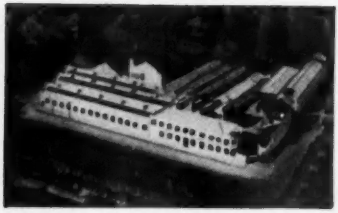

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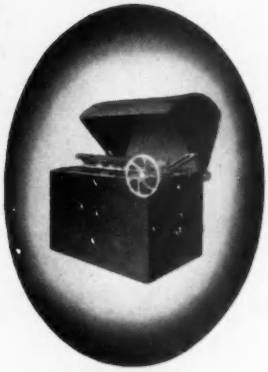

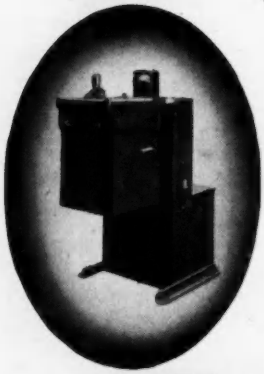

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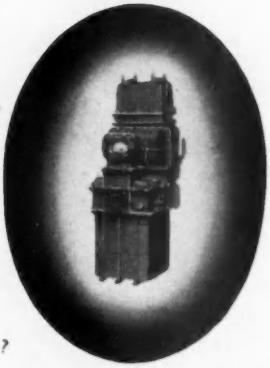

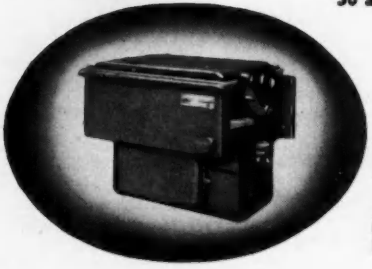

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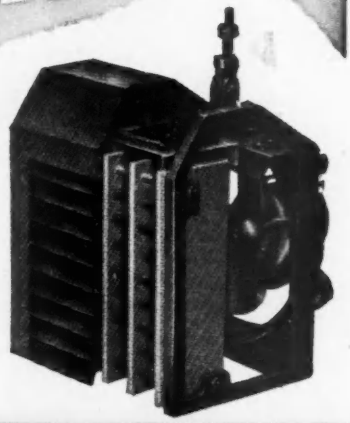

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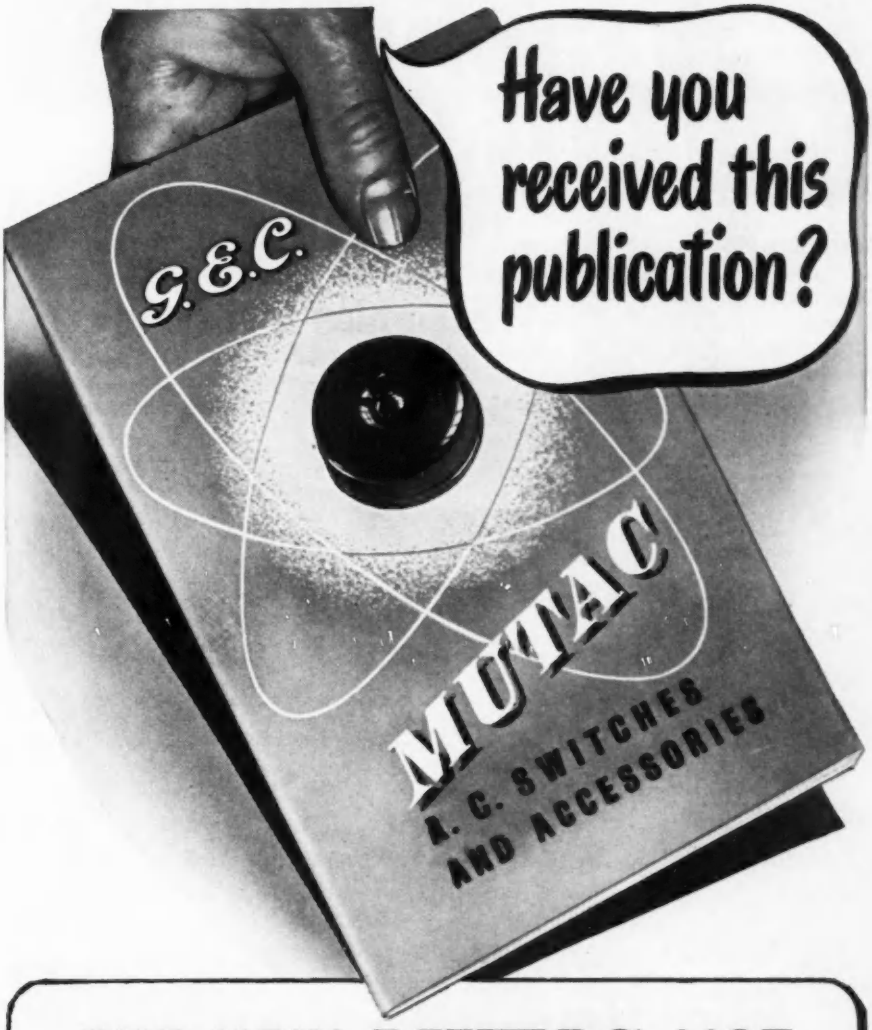

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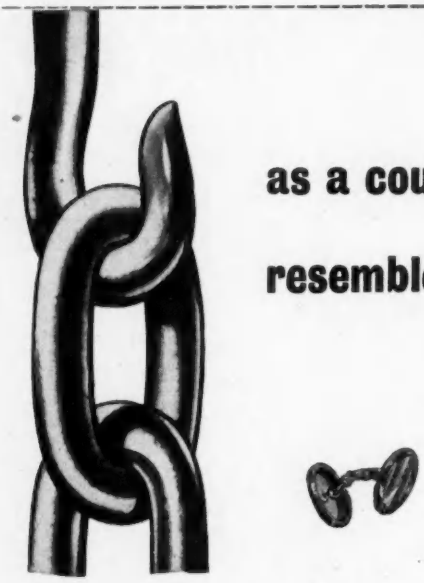

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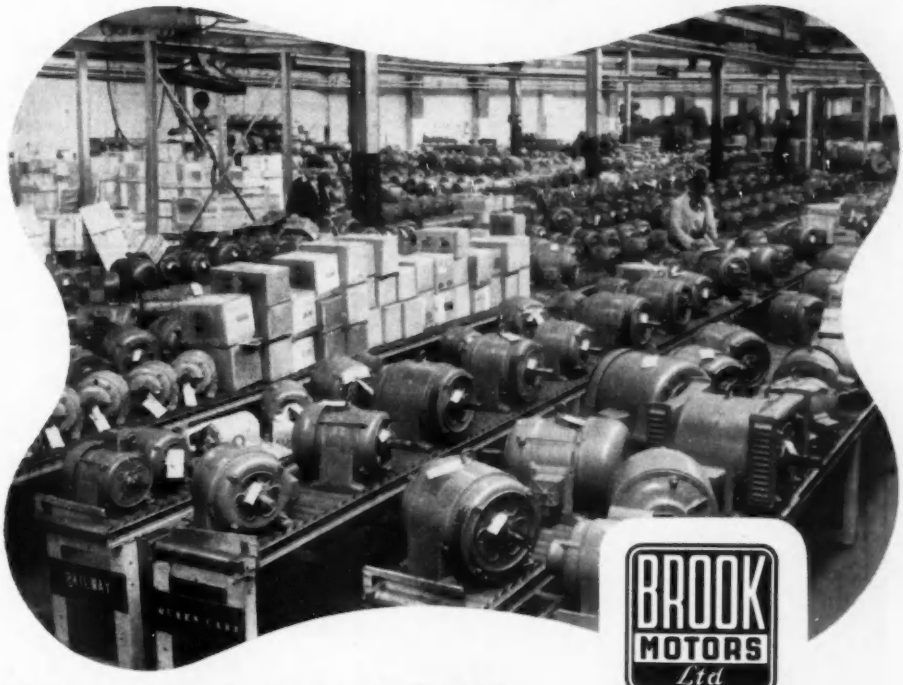

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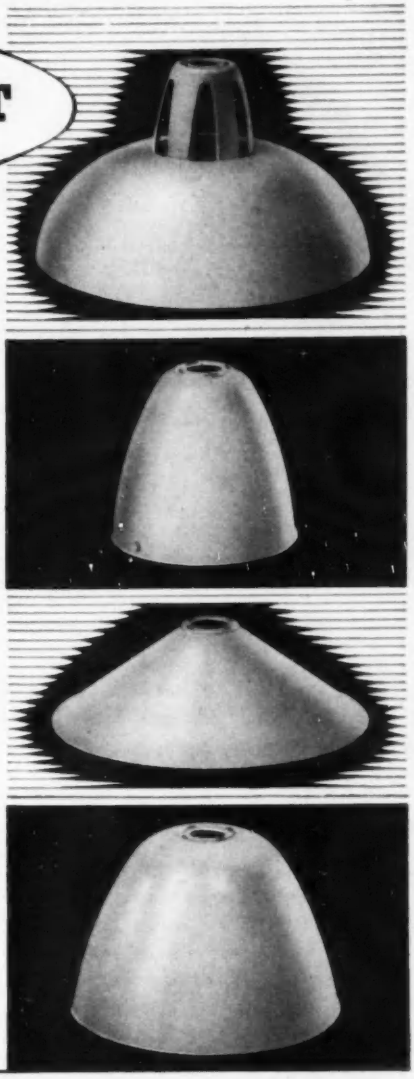

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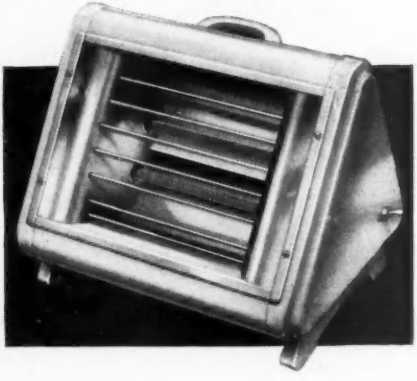

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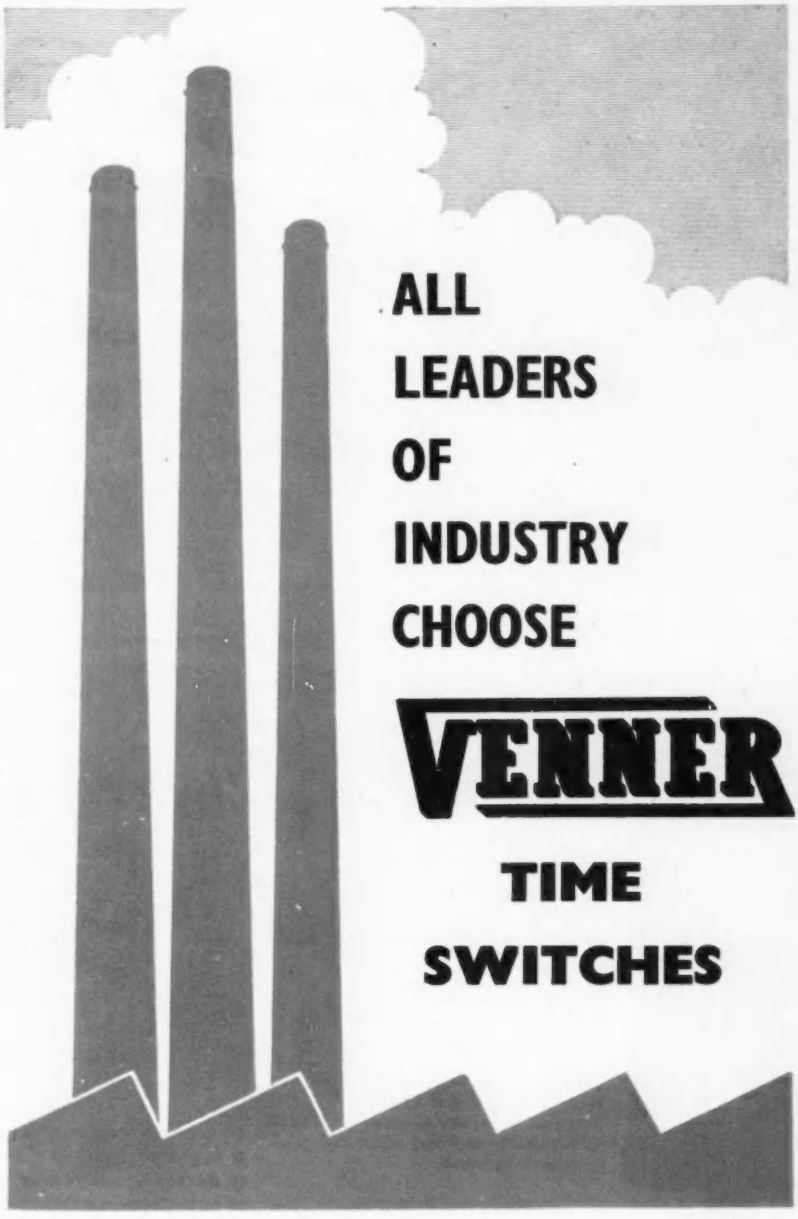

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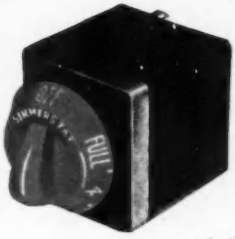

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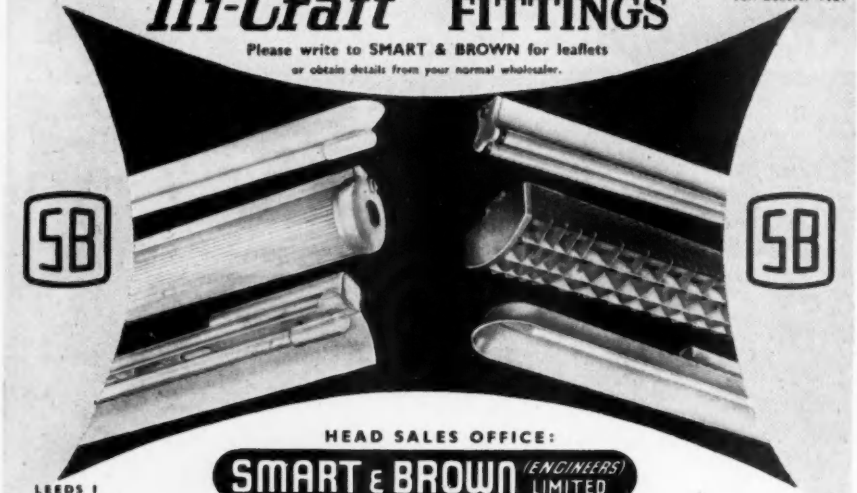

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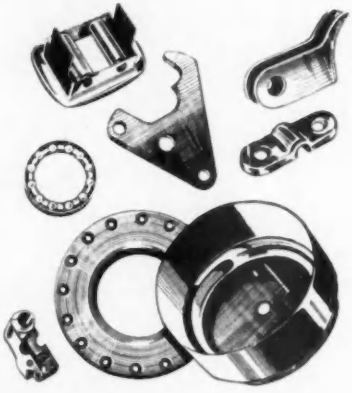

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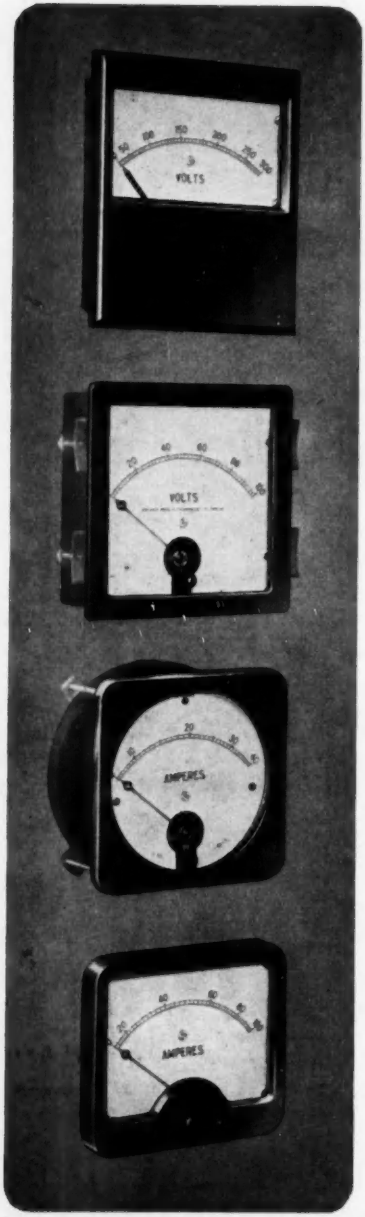

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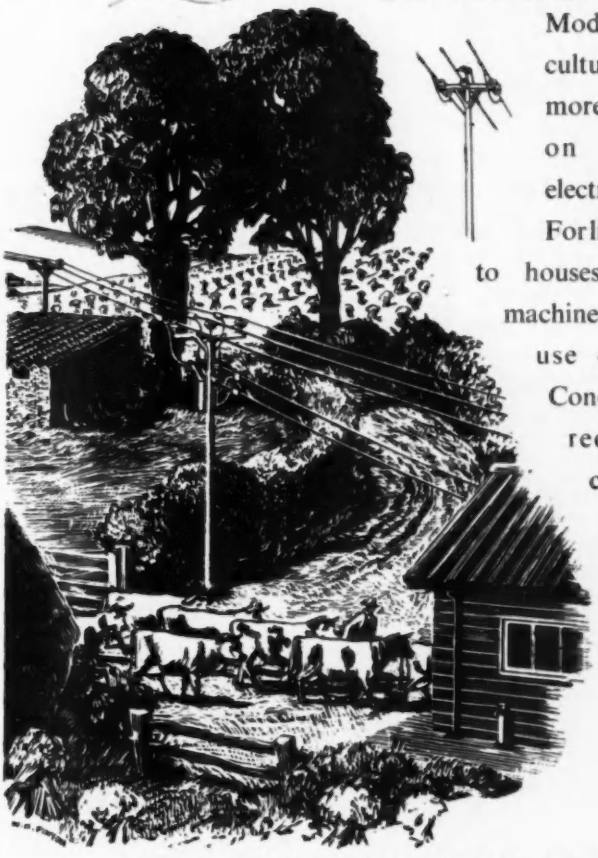

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STABILITY A 10 volt change in mains input voltage results in an output change of less than 0.15 volts.
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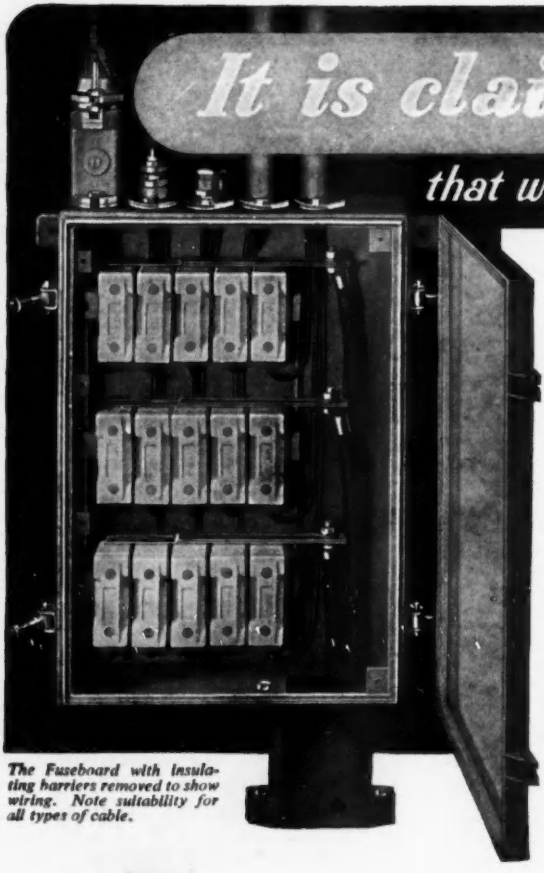

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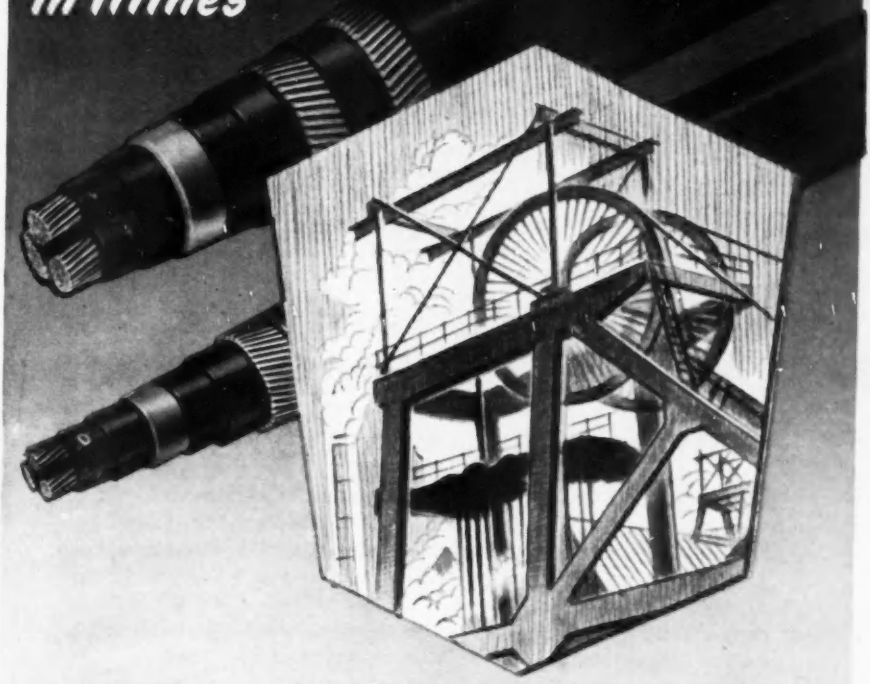

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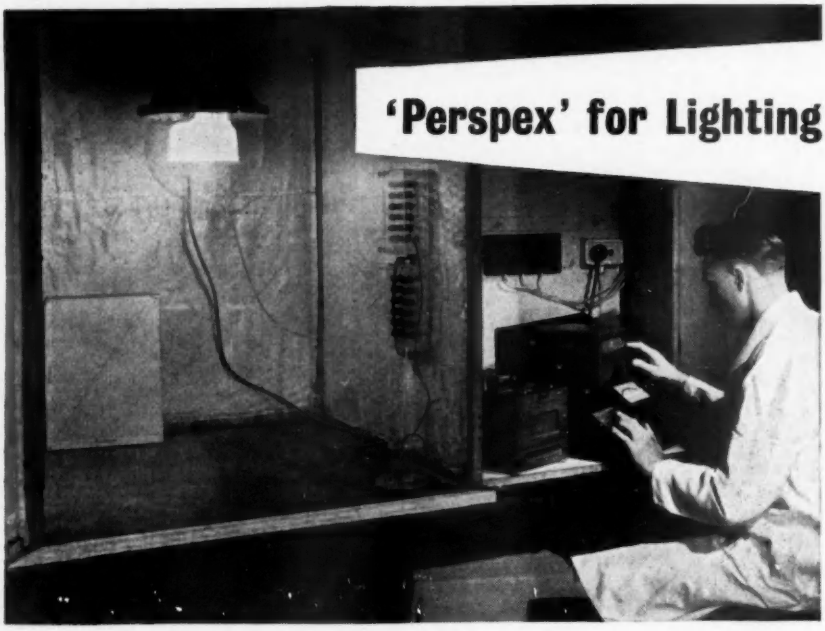

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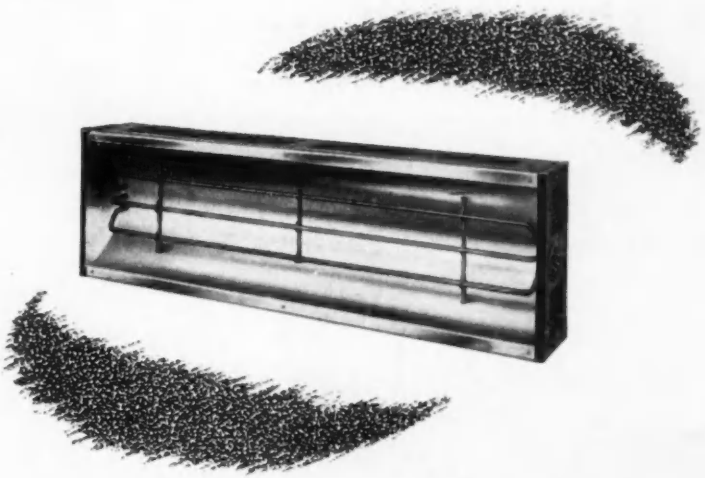

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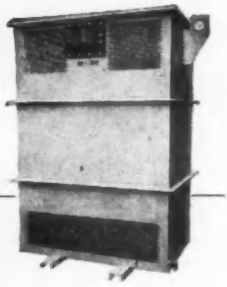

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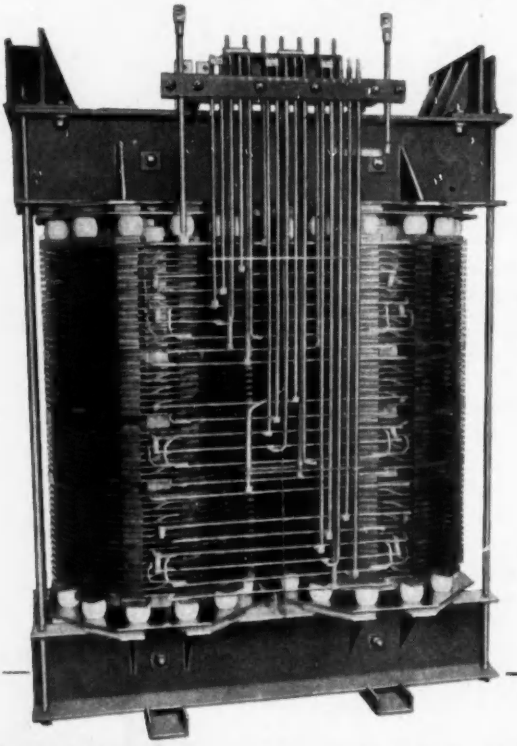

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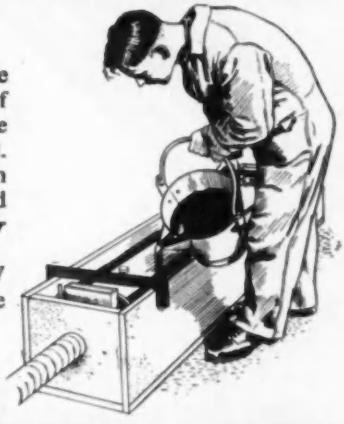

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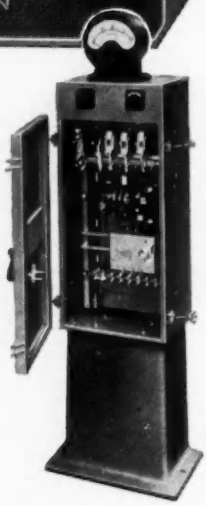

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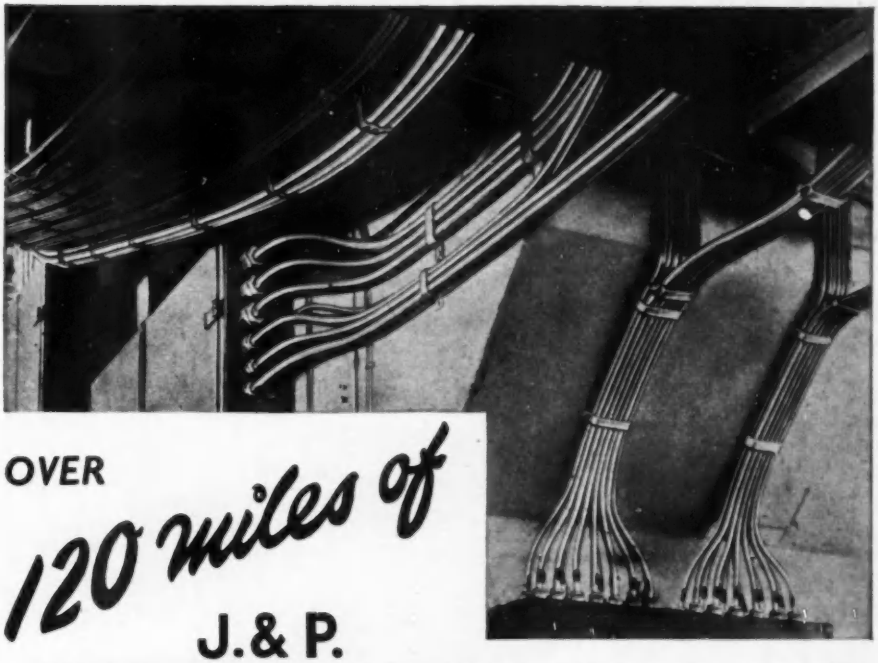

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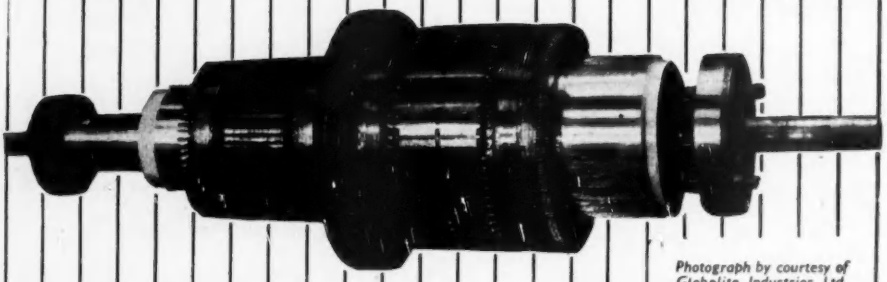

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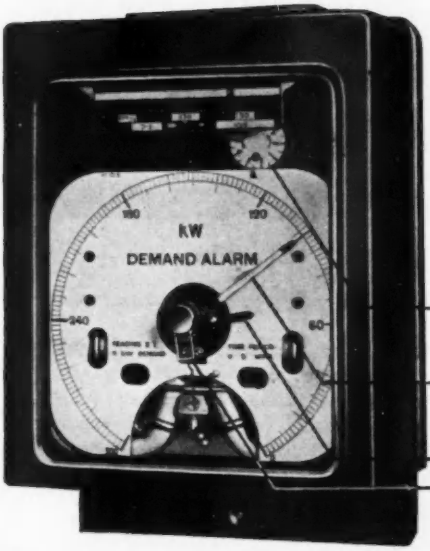

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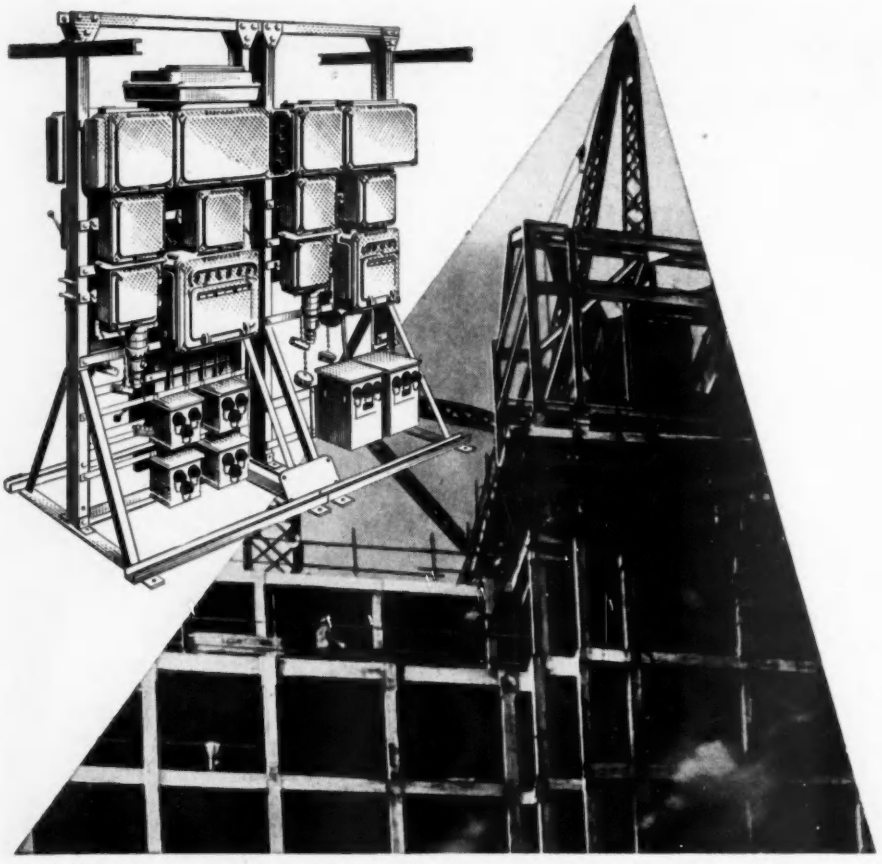

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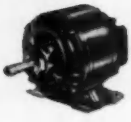

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Editorial

ATOM TRIAL

HOW soon nuclear power will be a commercial reality has been a live question in the electrical industry ever since Hiroshima. In the early post-war years, prospects were commonly thought bright for an early development, but a clearer view of some of the difficulties involved confirmed more sombre judgments, and forecasts began to speak warily of "decades." More recently, a moderate optimism seems to have returned both in this country and in the United States, based no doubt on successful experience with nuclear reactors used for experimental purposes and isotope production. Though the ideal nuclear power station cannot yet be set down on the drawing board, the time is ripe for the necessary, less economic, first approximation to this design. There are today experienced engineers who are willing to speak for the practicability of building a station which will, at the worst, generate at near existing station costs in terms of pence per kilowatt-hour generated. As soon as the not inconsiderable quantities of uranium required for such a project can be spared from other uses, the B.E.A., with direct financial help from the Government, if necessary, should attempt an atomic station, even though the fuel required is still scarce and methods of processing it costly. The knowledge that its construction and operation will give of the particular difficulties of working with radioactive materials cannot fail to prove most valuable in preparing for the larger and more efficient plants that will come later, even though these are likely to utilise a somewhat different and more complex type of reactor. They in their turn promise to banish the fear of fuel shortages which otherwise threaten the future, and to provide low-priced electrical energy in even greater abundance to the general benefit.

PRESCRIPTION FOR POLICY

TWELFTH night, which traditionally marks the last of the Christmas holiday, significantly saw a reopening of the campaign for solid fuel. In places as far apart as Glasgow and London, well-known protagonists were lecturing to selected audiences on the virtues of coal and coke and the need for a so-called national fuel policy. It is clear that they are still on the offensive against electricity and, although there were some welcome signs of opposition, much more will have to be done before the case for electricity succeeds in obtaining a fair public hearing. One significant factor emerged at these meetings, the solid fuel enthusiasts dislike the Ridley Report and will do their best to damn it. Their plea is for a "fuel policy" and, without going so far as openly to urge the compulsory restriction of electricity for domestic heating, there is little doubt of their intent. If such views are to be combated—and combated they must be if electricity is to retain any hold on the domestic heating load—then electricity must have its own forward policy for solving the fuel problem. It is not enough just to attempt to counter the assertations in favour of solid fuel. There must be a positive approach and it should not be difficult to find arguments less nebulous and erroneous than those for solid fuel. The one essential is that we also carry high a banner with the word "Excelsior" so that all the public can see we are at least as progressive as our critics.

LIGHTS ON THE ROAD

THE general findings given in the technical paper, recently issued by the Road Research Laboratory, on vehicle rear lights, will come as no great surprise to the motorist who has to drive at night. Nevertheless,

in the analysis forming part of the investigation, several interesting points emerged, one of which was the remarkable vulnerability of the electric battery cycle rear lamp. Comprehensive tests showed that a failure rate of 35 per 1,000 night journeys was averaged, and that this figure appeared to be common to all battery lamps irrespective of type or price. Of these failures, some 75% were due to broken bulbs or exhausted batteries, but the remainder were caused by those old enemies of the electrical industry, bad insulation, corrosion and poor contact. While it must be accepted that a cycle lamp has to operate under severe conditions of vibration and atmospheric exposure, and yet must be cheap, it is perhaps unfortunate that more attention has not been paid to the necessity for producing a more reliable unit. Modern techniques, together with experience gained in combating moisture and vibration during the past war, could well be applied to this problem.

SAFETY FOR SALE

PLANNED maintenance in the factory is a familiar idea. Has it any application in the home? Certainly there are some effective schemes in operation for specialised household electrical appliances, and for television sets, but there the parallel with industry ends. Any competent factory maintenance electrician has a scheme for giving particular attention to the sound condition of his protective gear, examining contacts, checking dashpots, and confirming the efficacy of earth connections. Can it be held that domestic installations do not need this care? Records of fires from electrical causes do not support this idea, and if the suggestion of some authorities, that more automatic protection be installed in the home, is adopted, then the need for regular maintenance will be still greater. Yet it is difficult for the industry to tackle this problem, which it has a moral obligation to solve, with but little financial incentive to compel its attention. Perhaps electricity boards and contractors will find an answer in selling safety as well as units and electric appliances. Skilful propaganda might persuade consumers to contract for periodical examination of their installations, made at a small annual fee, which would confirm that trips and fuses were in working condition and that adequate protection was available for all appliances and circuits. No doubt the floating of such schemes would present many difficulties, but they would offer one indirect advantage which is at first sight unexpected. Strong consumer identification with one electrical specialist would result from the working of such a scheme over the years. This should offer a valuable opportunity for the selling of further appliances and of adequate wiring, to the mutual benefit of all parties concerned.

COUNSEL ON COUNCILS

NOT unnaturally, perhaps, the severest critics of the work of consultative councils are those who played some part, albeit indirect, in creating them. The latest attack comes from the Fabian Society in a pamphlet by Mary Stewart. The now familiar demand for greater independence is reiterated. Councils should appoint their own secretary and all meetings should be open to the public. A more significant suggestion is that power be given to councils to join in making representation to the boards, Central Authority or Minister. Surely such steps could not be taken by any *ad hoc* group of councils but only by a properly constituted national council, the formation of which is opposed by the nationalised industries themselves for well-known reasons. Neither will the suggestion of joint district committees covering all fuels be readily acceptable. Their activities would by no means be simple with responsibility to three distinct and competitive councils. Further, with the additional recommendation of a central research organisation to advise council members, the sum total of powers would mean the setting up of an organisation parallel with the related industry itself. Surely the first need of nationalised industry is for simpler structure, not a more complex one.

Meteor

The Path towards NUCLEAR POWER STATIONS

New optimism is based on successful experience with reactors

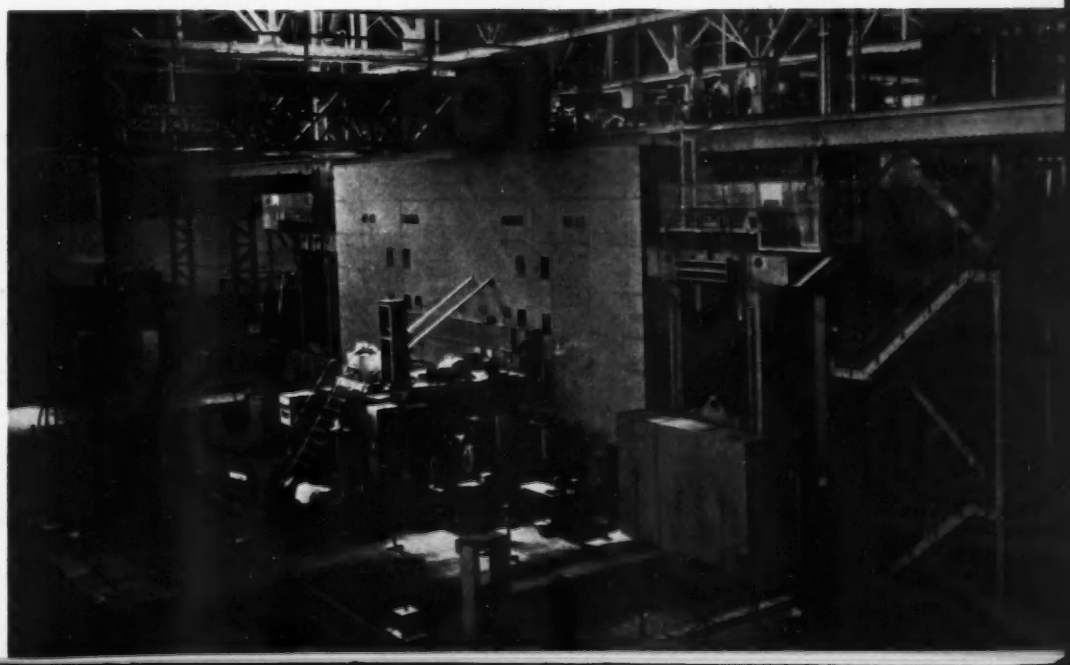
EIGHTY per cent of the necessary research effort for the development of the civil uses of nuclear energy is common to the military applications. This fact, recently stated before the Parliamentary Select Committee on Estimates, explains in some degree the silence that for four or five years has been maintained on the details of the probable development of atomic power sources for electricity generation. But now the pace is quickening. In America, a small atomic generating station is already in experimental operation. In this country, predictions of early developments are becoming more confident.

With this situation opening up, and with the prospect, stated last week, that the British Electricity Authority could build a nuclear energy station of sorts on a time scale comparable with that for a conventional thermal station, it is time to examine afresh the background of scientific and industrial organisation against which these developments are taking place.

Organisation

In this country, the whole of the nuclear development programme is conducted by the Ministry of Supply, principally through the Atomic Energy Research Establishment, so far as development work is concerned. Control is exercised by an Atomic Energy Council, which has the advice of an Atomic Energy Technical Committee, composed of ministry officials and scientists and engineers from outside the civil service. These "outside" members are invited to sit on the committee for limited periods, and an overall balance is maintained between the universities, industry, and other interests. The terms of reference of the committee are, to investigate matters remitted to it by the Atomic Energy Council; and amongst matters that have been considered is the reactor programme.

Harwell's sizeable BEPO reactor, shown below, has a charge of 28 tons of uranium. To power a 50 MW turbo-alternator from such a reactor, about 100 tons of uranium might be required



The progress of reactor technique must be the heart of any development of the civilian power applications of nuclear power, just as the reactor itself is at the centre of the atomic power station. Thus this committee is undoubtably exercising a key influence on the speed of advance of this country in this field.

In the United States, it is of course an "Atomic Energy Commission" which is charged with the development of nuclear power. This is organised as a commercial concern, though it has to receive all its capital funds from the Government at present, having no large source of income. This situation may be changed in the future when large reactors for civil applications of nuclear power come into operation and plutonium can be sold.

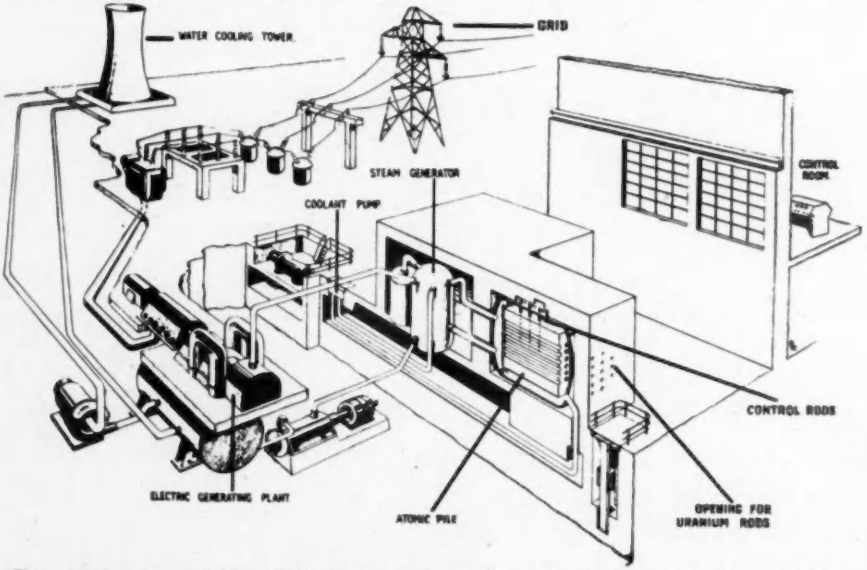
Private Enterprise

Private enterprise firms do, however, take part in the development of nuclear energy in the United States. Electricity generation utilities and chemical manufacturers have combined together in four cases to make cost and design studies for nuclear power stations with A.E.C. approval. This marks off an important difference from the position in Great Britain, and one which might well have considerable effects at a later date. It has been stated here that, up to a short while ago, there had been no direct industry participation in the programme. This has not been due to Government disregard of private firms. Conferences have been held at intervals of about a year, at which representatives of some large companies (English Electric, Metropolitan-Vickers, and Parsons have been mentioned) are made aware of the development programme. Up to early last year, however, they had indicated that, with their other commitments in the rearmament programme, they would rather not begin to participate in atomic development.

By now this situation may have changed, although no definite announcement has been made. It was stated last May that the Ministry of Supply was hoping to bring the large firms into the extended reactor programme which was then being mapped out.

Development

So much for organisation. But what is the probable path that development will take? By now the basic principles of the nuclear reactor are well known, and they were summarised again by Sir John Cockroft in his lecture last week to the Institution of Electrical Engineers (see page 99). Yet a choice still remains to be made between the various means available for making use of this energy. To summarise briefly, there is a large, "slow" reactor, which uses large amounts of uranium or other nuclear fuel at a relatively low efficiency, but is readily controllable. Alternatively the smaller "fast" reactor may be considered. This needs enriched fuel and offers far more problems of control



This sketch suggests schematically a possible layout for a slow-neutron-reactor power station

and of heat transfer, but has the overwhelming advantage that it lends itself to breeding: that is, it will produce, as well as heat, a surplus radioactive plutonium, which can be extracted at a later date and used to charge further reactors.

Probably the greatest problem facing those who would develop nuclear power reactors are metallurgical in nature. The reaction of materials on being exposed to strong bombardments of neutrons has not been under investigation for long, and many difficulties are being encountered. Indeed, it has been suggested that the relatively short life of materials may be the limiting factor determining the working life of a reactor.

Fuel Production

Before reactors can be started, fuel must be available. In this country the production of nuclear fuel is the responsibility of a range of large establishments operated by the Ministry of Supply. Imported concentrates of uranium ore are processed at Springfields (between Preston and Blackpool) to give pure uranium. In this state, the ratio of the active 235 isotope to the commoner 238 is 1 : 140. The product of Springfields is taken to Windscale, which is in Cumberland, between Seascale and Whitehaven, and it is there used in piles which produce fissionable material. Finally, there is a factory at Capenhurst, between Chester and Liverpool, the exact purpose of which has not yet been officially announced.

It is from these last two factories that fuel will be obtained if breeding reactors are developed as part of a power production plan. The fission material would at the same time be used to increase the total stocks and also to produce power. It is hoped that the first experimental breeder of this kind may be operating in 1956 or 1957.

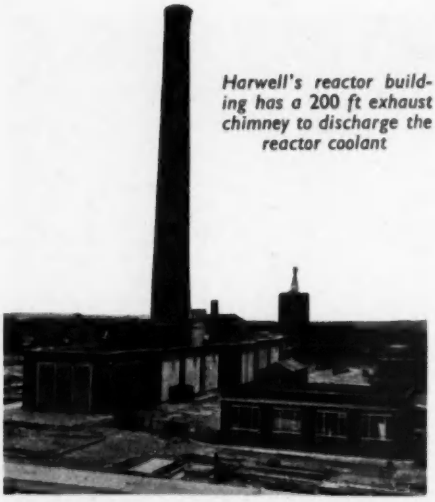
In the United States, rather more has been published about the production plants for atomic fuels. The latest series of establishments are being constructed in the Ohio valley, where the famous Oak Ridge station is situated. A factory at Fernald, just north of Cincinnati will process crude uranium ores and supply them to a series of plants where a gaseous diffusion method will be used to separate the fissionable U235 from its commoner companion. In the process concerned, use is made of the fact that a heavier gas diffuses through a membrane at a slower rate than a lighter gas. By applying this principle in a plant of many thousand stages to some gaseous compound of uranium, the difference in weights between the 235 and 238 isotopes is used to bring about the desired separation.

A vivid impression of the hazards of radio-activity is given by this example of the protective clothing seen here. It has to be worn for certain classes of maintenance work at the Harwell station

Experimental Station

The American Atomic Energy Commission has already brought into operation an experimental power generating reactor at its Argonne National Laboratory. This makes use of the breeding principle already discussed, by which plutonium is generated at the same time as heat for steam raising, and the yield of plutonium from the transformation of U238 more than compensates for the consumption of U235.

In the description of this plant that has been issued, it is stated that the reacting core of the unit is about the size of an American football. The reactor is, of course, of the "fast" type, in which the heat source is small, and the problem of heat removal one of the major limitations in design. The core consists of either enriched uranium or of plutonium—it has not been revealed which—and it is surrounded by a blanket of natural uranium. Neutrons escaping from the core are captured in the blanket, where they give rise to plutonium which, at a later stage, can be extracted by chemical processing. The coolant used in this reactor is an alloy of sodium and potassium, which is liquid at room temperature but boils at 1,500° F. It is circulated first through the blanket of uranium and then through the reactor core, emerging at



Harwell's reactor building has a 200 ft exhaust chimney to discharge the reactor coolant

a temperature of 660° F. Heat is extracted from the alloy in a heat exchanger, after which the coolant is pumped to a storage tank by an electromagnetic pump.

All the plant so far described is intensely radioactive, and has to be shielded by heavy concrete walls. On the other side of the heat exchanger circuit another charge of the sodium-potassium alloy flows, and this emerges in a non-radioactive condition. It passes to a steam boiler and super-heater, which supplies a turbine of conventional design. This is a 250 kW set, operating with 400 lb/sq in. steam.

Commercial Plans

So far no plants have been built off the large official atomic energy reservations in America. Obviously, real commercial operation will have to take place away from such protected localities. This is one of the points at which the utility-chemical firm groups already mentioned come into the picture. One group has produced plans for a breeder reactor station, and is hoping to develop the necessary engineering designs within the next twelve months. It proposes to finance the whole project from group resources, although the costs involved are estimated to be more than the 227 dollars/kW (£81) which is believed to be the maximum investment that can be justified on a basis of immediate results. However, it is thought that construction within such a limit would be possible once experience had been gained.

The other proposal to come from a similar group evisages the construction of a large-scale installation at the expense of the Atomic Energy Commission, who would both supply the fuel and extract the plutonium. The supply company would pay for and own the conventional part of the station and the intermediate heat interchangers, etc. Payment would be made to the government for the difference between the value of the electricity generated to the utility and the actual company expenditure on its generation.

Forecasts

It is appropriate as a conclusion to this article, to recall some of the recent statements on the prospects for nuclear generation of electricity. First to be considered may be Mr. Philip Sporn, President of the American Gas and Electric Company.

Mr. Sporn states that the unsolved problems which made nuclear power costly are quite technical, but, in spite of them, he recognises solid progress in the experience of the last year or so. He also notes the heavy requirements for fuel of all types forecast by the President's Material Policy Commission. Yet he suggests that within the 25 years that survey covers, nuclear power will only begin to make a significant contribution to national energy requirements. His conclusion is that too much attention must not be diverted from the development of non-nuclear means of making fuel more readily available: they promise more immediate returns, and these on a wider scale.

In Great Britain authoritative speakers have similarly spoken of large-scale atomic-powered electricity as some way off. Sir John Hacking, in his widely discussed speech at the Institute of Fuel last May, forecast that a set of major dimensions would probably be running on atomic energy by 1959, but suggested that the general use of this fuel was a long way off. Sir John Cockroft, whom we report elsewhere in this issue, has effectively confirmed this time scale as regards slow neutron-reactor stations. There has also been emphasis in this country on the need to maintain the pressure of research in other sections of fuel technology. Mr. Sporn's views on this important matter of national economics have wide support on this side of the Atlantic.

So the real significance of this quickening interest in nuclear matters and electricity generation is that action is at last emerging from the speculation of recent years. Research work and development investigations have resolved many of the more serious doubts about the economic practicability of using heat from nuclear fission to drive steam power stations, and it is now the engineer, the metallurgist and the chemist who have to evolve the details of a successful scheme.

Nuclear Generation in Great Britain

Sir John Cockcroft reviews Prospects for the Future

AS a background to the three papers on reactor instrumentation which were read last Thursday, a lecture on "Nuclear Reactors and their Applications" was delivered by SIR JOHN COCKCROFT, C.B.E., M.A., PH.D., F.R.S., M.I.E.E. (Director, Atomic Energy Research Establishment), to the I.E.E.

Sir John keyed his comments on the theory of the reactors to the BEPO installation at Harwell, which uses graphite to moderate the reaction. This is an example of a slow (or thermal) reactor, in which the neutrons are slowed from a velocity representing an energy of 1 MeV ($4{\cdot}45 \times 10^{-20}$ kWh) to one-fortieth of an electron volt. As the neutrons slow down, the number producing fission of the uranium rises and thus heat rapidly.

A second important form of nuclear reactor is the fast type, which uses no moderator. In this a chain reaction is possible only if the core consists quite largely of the lighter isotype of uranium (U235). Intermediate reactors, in which the neutrons are moving at a particular resonant speed, may become important for mobile power plants, etc. It is also possible that with enriched fuels, a homogeneous reactor may be possible in which there is no need for the uranium to be segregated in bars as is done for the thermal type.

One of the fundamental relationships in nuclear reactor design is the balance of neutrons. Some excess above what is wanted to supply initial losses and continue the chain reaction is necessary because as the pile working proceeds, the loss of neutrons increases. Control rods are installed to absorb the excess in the early stages of the run. Ideally, the engineer must attempt to reduce losses in the reactor until the reactor will produce more secondary fuel (plutonium) than the primary U235 used up and also use all the heavy (U238) uranium as well as the light (U235).

For all this work experience with actual reactors are necessary, and if a high-output plant is to be constructed it is worth while building a zero-energy reactor for experimental purposes in the design stage; this does not require the shielding necessary for the larger unit.

Heavy shielding is necessary for the protection of personnel working on nuclear reactors. As a working rule, 1 ft of concrete may be taken to reduce the neutron flux by a factor of ten. The 6 ft 6 in. of heavy pyrites concrete on BEPO, plus 6 in. steel, reduces the radiation level by 10^9.

The reacting core at the centre of the pile is permeated by a high intensity of electromagnetic radiation and bombardment by high-speed neutrons. The neutrons have important chemical effects, and metallurgists have the task of developing suitable metal sheaths for the uranium rods. Uranium when exposed to a flux of neutrons or to thermal cycling can distort very badly, and without adequate sheathing the fuel rods may collapse almost completely. This is a most serious prospect because failure of the sheath may release radioactive products into whatever cooling medium is used.

One of the uses of the reactors at present available is for the production of radioactive isotopes for scientific and medical purposes. The demand for these is now exceeding the supply, and the A.E.R.E. are considering building a heavy-water-moderated reactor to supplement their present sources. Such a unit can be smaller than the graphite moderated pile.

Power Production

When the use of atomic energy for power purposes is considered, there are two principal objectives. The first is to reduce the cost of energy and to increase effective fuel reserves; the second to provide power in situations to which fuel in bulk cannot be transported.

It has to be realised that a power station using a slow neutron reactor will be little smaller in size than a conventional thermal station. With this assumption, it is possible to investigate in the broadest terms the economics of such a station.

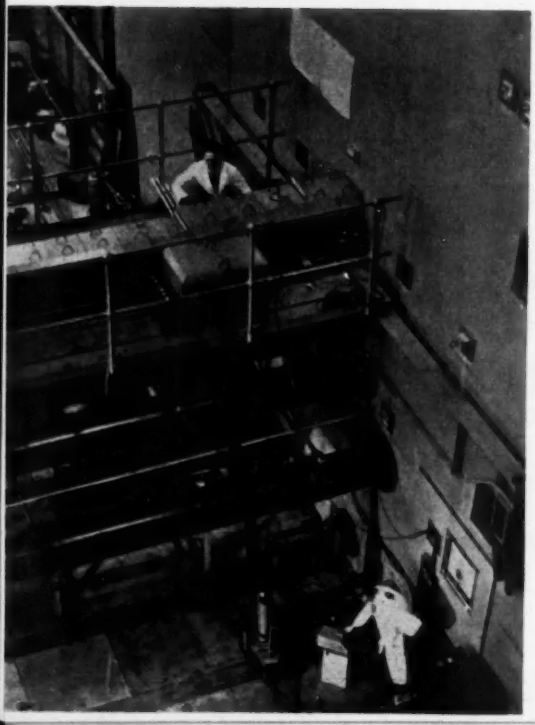
To obtain reasonable thermodynamic effici-

ency, the fuel elements in the reactor must operate at 350-400° C, which may permit an overall efficiency of 25%. The power output of the first reactor built will presumably be determined by critical size considerations, because a value of MW/ton of uranium as high as is possible will be sought.

If a 50 MW station is considered, then the heating rate of the reactor at 25% efficiency will be 200 MW. At about 2 MW/ton of uranium, this suggests 100 tons of uranium as the initial charge. At an assumed cost of uranium of between £5,000 and £15,000/ton (this checks with American estimates) the cost of the initial charge is likely to be £1,500,000.

Next, the life of this charge has to be considered. This depends on the neutron balance sheet. If it operates until all the light isotope (U235) is used up, it will last ten years. This gives £150,000/year fuel cost, or about one-fifth that for coal. As a possibility, however, it may be assumed that the charge will have to be changed when only one-quarter of the U235 is used. In this case, the cost will be only slightly less than for other fuels. Moreover, it may prove that the life of the metal-sheathed fuel elements may impose the determining limit on the life of the charge of uranium, and this would make matters still worse.

Control rods for the BEPO reactor are seen in this view from overhead



Assuming that the capital cost of such a nuclear power station were twice that of a conventional station, the total cost of generation would be 0·7d./kWh under the worst conditions considered, which is slightly higher than current costs. This cost may be expected to decrease, however, as experience is obtained.

WORLD FUEL RESOURCES IN ENERGY EQUIVALENTS

(*Units are* 10^{18} *B.Th.U.*)

U.S.A.	7·6
Canada	2
United Kingdom	1
Russia...	10
China	6
Others...	7
	33·6

Annual yearly consumption, 2x 10^{17} B.Th.U.

At the end of the useful life of the fuel it will contain a substantial amount of plutonium, and this can be extracted by chemical processing and used in the breeder reactor programme. Breeder reactors are really necessary if the consumption of uranium is to be kept down to a reasonable level. The main hope for these, appears to be to use a fast reactor.

Such a fast reactor would have a core of plutonium or of enriched uranium, and perhaps a liquid metal coolant. There are many quite serious problems about developing a high power reactor of this type. The MW/lb ratio will be high, and there will be a strong likelihood that if the coolant fails, the core will melt, with disastrous results. The core will be removed at intervals for chemical processing, and the cost of this work will be an important factor in the economics of nuclear power generation. Not enough is known about this to make possible a worthwhile estimate of overall costs.

Summarising the position, Sir John said he was fairly certain that large-scale natural uranium-using power stations could be built on a time scale similar to that for conventional stations, and with a cost of the same order. It was essential that such a station be built in order that experience could be gained. Low power fast-fission units had also proved practicable, but for large units many problems had to be solved which were still being investigated.

Some idea of the urgency of the problem was given by a recent American revaluation of world fuel stocks, which is shown in the table. In terms of the unit used there, reserves of uranium at $100/lb cost are 1,700; and at $50/lb, 250. If breeding is achieved successfully, the primary fuel cost will be relatively unimportant in production economics.

Reactor Control

The Operation and Instrumentation of Nuclear Reactors

FOR reasons of safety, as well as for operational convenience, close control must at all times be exercised over the functioning of a nuclear reactor. For the thermal reactor the means of control are readily available in the form of rods with high neutron capture, which are pushed in and out of the reactor pile. Technique has advanced rapidly, and the present situation is summarised in a group of three papers* presented to the Institution of Electrical Engineers on Thursday last by members of the Atomic Energy Research Establishment.

Thermal Neutron Reactors

In the thermal neutron reactor, neutrons are slowed down by a moderator to a state of thermal equilibrium, at which there is a comparatively high probability of fission being provoked in a Uranium 235 isotope. As a result of this reaction, two or three further neutrons are produced. Some of these are lost by capture in the structural material of the reactor and others escape altogether. By correct design, however, and by the elimination from within the reactor of materials having a high absorption affinity for neutrons, a sufficient proportion of the neutrons "born" at a fission are preserved to continue the chain reaction.

At each fission kinetic energy amounting to 180 MeV is released and degenerates rapidly to heat. The need to provide means of removing this heat is an important consideration in reactor design.

Three states of reactor operation may be considered. There is the critical state, in which the number of neutrons in the reactor just remains constant, a divergent state, when they are increasing, and a convergent (sub-critical) state, in which there are increasingly fewer neutrons at each generation. The usual form of denoting the state is to consider the "spare K"—the fractional proportion of neutrons in excess of those present in the preceding generation.

One complicating, though useful, characteristic of the fission process is that not all the neutrons freed by a fission are released at the cataclysmic instant of its happening. A small fraction, 0·76%, emanates from the decay of radioactive fission products and is up to 80 secs "late," and this fact provides a time-lag in the sequence of neutron reactor events.

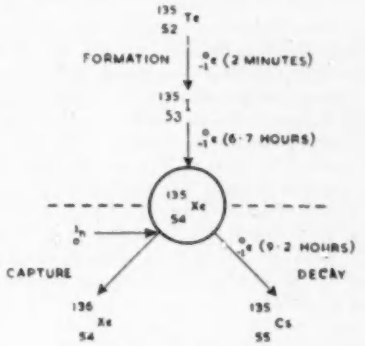


Fig. 1. Formation and loss of xenon poisoning in the thermal-type of nuclear reactor

Considering once again the core of a thermal neutron reactor, which consists of a number of cells, the events in one cell may be considered. When the reactor is operating at full power, the number of fissions every second may be about 10^{16} (it actually depends on the neutron density). Heat is produced instantaneously in the uranium metal and is removed by some coolant. The graphite moderator, however, acts as a heat sink and imparts some delay to the temperature rise of the coolant.

Changes in Reactivity

An important long-term cause of change in reactor energy is the depletion of the primary fissionable nuclei in the charge. This is to some extent compensated by the production of plutonium 239, but such effects are far outweighed by short-time happenings of a greater magnitude.

Poisoning is one of the principal effects concerned, and xenon is the cause. Its mode of

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* *R. V. Moore, G.C., B.Sc.(Eng.), A.M.I.Mech.E., M.I.E.E.: "The Control of a Thermal Neutron Reactor." J. H. Bowen, B.Sc., A.M.I.E.E.: "Automatic Control Characteristics of Thermal Neutron Reactors." T. A. Jaques, H. A. Ballinger, A.M.I.E.E. and F. Wade, Associate I.E.E.: "Neutron Detectors for Reactor Design."*

formation is illustrated in Fig. 1, and it has a very high ability to capture thermal neutrons. It disappears from the pile in two ways: either by decay to an isotope of caesium, or by capture of another neutron, with consequent formation of a non-neutron-absorbent isotope of xenon.

On steady operation the effect of this poisoning soon reaches equilibrium, but it imposes a time-lag if the pile operation is slowed down and then increased again. During the slowing down period the formation of xenon from a relatively long-lived iodine isotope continues, initially at an unaltered rate, but the compensating change of Xenon 135 to Xenon 136 is reduced because fewer neutrons are available. Thus, reactivity is repressed further than the intended amount.

Another important effect on reactivity is exercised by the temperature at which the reactor is working. Both uranium and graphite have a negative temperature coefficient as used in B.E.P.O. at Harwell; that is, any increase in temperature causes a decrease in reactivity. This gives the chance, by correct design, of ensuring that even if the coolant is lost, the pile will be self-stabilising. Increase in uranium temperature causes the nuclear power to fall off rapidly, and as a result the temperature begins to fall in sympathy, without a safe level being exceeded.

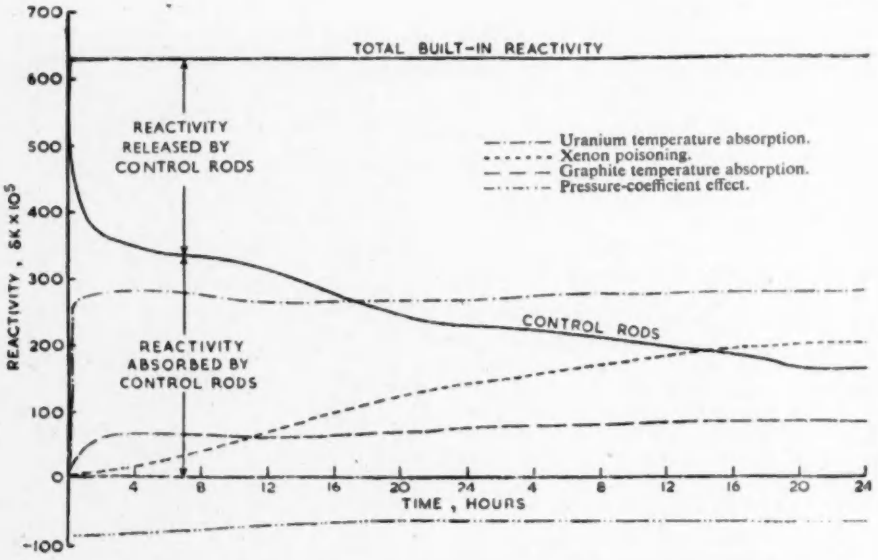
Control Principles

Reactors are designed with some excess reactivity which can be absorbed by adjustable control rods of cadmium or boron. This permits the changes in reactivity with time to be allowed for (see Fig. 2). One of the effects that has not so far been mentioned is that of the coolant. If air is used, as in Harwell's B.E.P.O., its nitrogen content absorbs some thermal neutrons and reduces reactivity. With the operation of induced draught fans, pressure is below atmospheric and the effect is reduced.

Compensation for reactivity is provided by two systems. First, there is one which will absorb all excess reactivity, but is so designed that the release of positive reactivity occurs slowly; then a regulating system, very fast acting, which absorbs a limited maximum value of reactivity. With the regulating rods set in motion automatically, the control rods can be made to follow to restore them to their mid-point of travel. To the other rods must be added safety rods, which have two positions only—full in or full out.

Operation

In its quiescent, shut-down state, reactor power may be of the order of milliwatts. It must be increased to operating power very



Variation of reactivity of the Harwell B.E.P.O. reactor on starting-up after a long shut-down

carefully to avoid an overshoot which might be dangerous. This operation is rendered more difficult because of the difficulty of measuring sub-critical nuclear power. If the control rod is withdrawn too rapidly, then the safeguard of the delayed neutron effect may be to no avail, the increase in prompt electrons being sufficient to take the increase in reactivity into a dangerous, super-critical range.

The safest way of starting the reactor is thus control rod withdrawal at a strictly limited rate. This is a slow proceeding, however, which may take several hours. Delay can be minimised by reducing the frequency of complete plant shut-down. Many maintenance functions can be performed with the reactor running at a power of a few hundred watts.

Measurements

Neutron detectors of various kinds have to be used in the course of reactor operation, and ionisation chambers have been found specially useful. In regions of high neutron flux, a thermopile with alternate junctions coated with boron or some other suitable material has been applied very successfully. Thermo-junctions are connected in opposition for ambient temperature cancellation. When the boron-coated junctions are bombarded by neutrons, a nuclear reaction occurs with the transmutation of boron to lithium and the release of heat energy. Thus an e.m.f. is generated in the thermopile which gives a measure of the neutron flux.

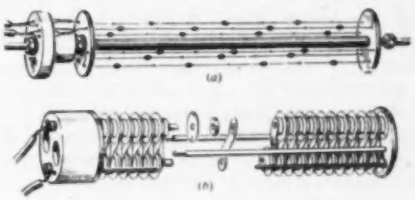
Ionisation chambers, which are discussed in the papers in some detail, have been the subject of a number of refinements. The range of types now in existence is capable of controlling a reactor over a neutron flux range of 2×10^5, and it is hoped that the use of gamma-ray compensated chambers will enable this range to be extended to 2×10^7—a maximum limiting flux of 4×10^{10} neutrons/cm² and a minimum of 2×10^3 neutrons/cm².

DISCUSSION

MR. DENIS TAYLOR (A.E.R.E., Harwell), who opened the discussion, said that Mr. Moore had paid special attention to the operating conditions at starting-up, and he was right to consider methods of starting-up which did not involve the measurement of neutron flux. There was a great deal to be said for his method of control-rod withdrawal at uniform velocity, although it might have only a limited application.

There was a great deal to be said for controlling the rod position so that the power level increased at some predetermined rate as determined, for example, by a neutron flux measuring instrument with a logarithmic response. R. J. Cox and others at Harwell had been considering that question and were experimenting with electronic apparatus which appeared to be suitable for the purpose. They used pulse counting at the low-power levels and normal d.c. measurement at the higher levels.

MR. W. A. KEALY (A.E.R.E., Risley) said that



These are two types of thermopile used for neutron flux measurement, (a) uses boron beads on alternate junctions of chromel-P and Alumel wire: and (b) 2% boron steel discs in conjunction with iron and Constantan

the method of control adopted for the pile would depend to a considerable extent on the use to which the pile was being put. For example, on an experimental reactor, such as B.E.P.O., the most important thing was probably in most cases to keep the neutron flux constant, or to vary it within some prescribed limits during the course of the experiment. Where the primary function of a pile was the production of isotopes, it was important to keep it running at maximum permissible flux, and that was conditioned by the maximum permissible fuel-rod temperature. A change in grid frequency could, by varying the speed of cooling, cause a change in fuel-rod temperature of 6°.

MR. L. C. LUDBROOK (B.T.H., Rugby) indicated that linear theory could be used to predict the response to arbitrary disturbances of small amplitude and short periods. He also showed that by using simple Heaviside expressions it permitted a quick approximation to be found from the given nuclear data. The Institution owed a particular debt to Heaviside, and on that memorable occasion it seemed appropriate to record that his operational methods handled the modern problems just as simply as they did the telegraph problems over fifty years ago.

MR. S. A. GHALIB (Metropolitan-Vickers Electrical Co., Ltd.) referred to Mr. Moore's paper and said that as an electronic control engineer, he often found that there was a tendency on new projects for enthusiastic physicists and engineers to over-complicate the equipment in order to achieve just a little better performance. It was gratifying to see that there was no such tendency in the case of under discussion.

There were several other speakers.

Accidents at Night

D.S.I.R. Investigates inadequacy of Vehicle Rear Lights

A TECHNICAL paper of importance to all road users "Rear Lights of Motor Vehicles and Pedal Cycles" has recently been issued by the D.S.I.R. Road Research Laboratory, and is available from H.M.S.O. price 1s. 6d.

The chief virtue of this paper is that it reproduces officially many of those rear lighting defects which the average road user knows only too well from bitter experience,

Accident Analysis

Statistically, the paper gives an analysis in two ways of the accident records for the three-month period October to December 1949. These analyses gave the ratio of "number of night accidents/number of day accidents" for various types of two vehicle collision, and a comparison of the night/day accident ratios for pre-war and post-war cars, the latter having much brighter rear lights. Abnormally high accident rates were shown for parked vehicles hit in rear, temporarily held up vehicles hit in rear and moving pedal cycles hit in rear. As far as old and new vehicles went, the night/day ratio for private cars was nearly five times as great for the pre-war as against the post-war for the same types of accidents.

The work on accident statistics indicated that rear lights of post-war cars were generally adequate, but those on pre-war cars and most commercial vehicles (both pre- and post-war) were generally inadequate. A survey of rear light intensity was made in the winter of 1950-51, showed that the rear lights of about 75% of all motor vehicles fell below the S.A.E. standard of 0·25 candela, and incidentally a count in the London area showed that 3% of cars and commercial vehicles, and 12% of all pedal cycles were showing no light at all. Several visibility tests were carried out and the conclusions reached showed that 0·25 candela was certainly not excessive, particularly when the following driver was under glare conditions from an approaching vehicle. It was also concluded that judgment of distance was significantly improved by the presence of two rear lights spaced two ft. or more apart.

Cycle Lamps

At the time the survey was made, new lamps for pedal cycles had intensities of between 0·14 and 0·008 candela, but 50% of cycles on the road were less than 0·007. To bring the intensity up to 0·25 candela, larger batteries would be required. A check survey at Slough showed that out of 1,518 cyclists passing a point, some 46 had no rear light. Of these 40 were stopped and the lamps examined. Three had no rear lamps at all, 22 had faulty battery lamps and 15 had faulty dynamo lamps. Half of the faults were due to bad connections or faulty wiring, defects which might be greatly reduced by better design.

Tests of reliability were carried out on seven lamps of each of eight popular types varying in price from 2s. 6d. to 5s. 0d. It was found there appeared to be no apparent connection between the price paid for a lamp and its light intensity or its reliability. Faults found were due to batteries swelling and corroding the case, corrosion and loosening of the bulb locking nut, shorting of the battery, worn bulb case, bad contacts and thread stripping. It was concluded, however, due to the results of these tests, that the failure rate for battery lamps was 35 per 1,000 night journeys and for dynamo sets 13 per 1,000 night journeys.

Inadequate rear lights cause about 3,400 casualties a year at an estimated cost to the community of about £2,000,000 per annum.

This Austin truck is safely equipped with Joseph Lucas twin tail lamps supplemented by reflex reflectors

Our readers' views . . .

Lighting Variants

IS it not time that some central authority was established for the control of types of street lighting on main through roads. A quick check taken a few days ago when driving from Aldwych to Euston—a straight road of just over a mile in length—showed some six variants of gas and electricity to be in use. In fact the only general type missing seemed to be sodium vapour. Cambridge, according to your last issue, seems to have adopted a rational, comprehensive scheme, but London boroughs seem to look round to find some form of lighting which will be different from that adopted by all their immediate neighbours.

Lux in Terœbris

LONDON, S.W.14.

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Meter Problems

MR. K. B. POTTER, writing under the heading "Meter Problems" in the issue dated January 1, mentions a "welding transformer of the two-phase type," shows it in his diagram as being single-phase, and proceeds to make his calculations and draw his vector diagrams as for a three-phase supply. In view of this, I venture to suggest that he has quite the wrong impression of the problem as first put forward by R.F.K.

K. B. Potter's problem concerns only the correct metering of a single-phase load connected phase to phase on a three-phase system, and it is therefore *not* similar to R.F.K.'s problem. The calculations given merely prove that in his case the algebraic sum of two single-phase meters (connected as shown) give the correct result, as would a single meter, and the negative reading is due simply to the fact that the vector position of the voltage applied to the load (phase to phase) is different to the vector position of the voltage applied to the meter potential coil (phase to neutral), and is therefore no mystery at all.

In R.F.K.'s case the load is a true two-phase four-wire load and one meter runs in reverse *in spite of* the fact that its current and voltage vectors are identical with that of the associated section of the load. I therefore continue to think that the solution I advanced (Our Readers' Views, November 20) is the correct one.

I should like to add that since correspondence on this question has been going on I have been asked to explain why the same phenomenon is not experienced on three-phase systems and delta loads when using three single-phase meters. Here the answer is that since the voltage vectors are symmetrical and mutually spaced by 120 the effect is self-cancelling because what happens on any one phase must happen on all three phases, and this rules out any possibility of one phase exporting power.

Such an effect as I advanced as being the cause of the meter reversal in R.F.K.'s case can only take place on a two-phase system, where the 90° separation of A-B and the 270° separation of B-A will only allow of power interchange between phases in one direction.

R. Wells
A.M.I.E.E.

WALTON-ON-THAMES

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Suppression and Performance

HAVING read in your issue of December 4 a digest of the regulation for the control of interference by ignition equipment, my conscience at last came into operation and I arranged to have my motor car engine suppressed.

As a keen motorist, I watched the performance after suppression with a certain amount of curiosity, and I find that, on the whole, suppression, at least by distributor head resistance, makes little general difference. Initial starting appears unaffected; pulling when the engine is fairly cold seems however somewhat worse and is accompanied with a fair amount of misfiring. When the engine has been warmed up, performance is normal up to 65 to 70 m.p.h., but after that I think there is some falling off. This latter is, of course, difficult to estimate as occasions when one can travel at over 65 m.p.h. for any distance are comparatively rare at this time of year in Great Britain.

I would, however, be interested to know if any similar phenomena have been experienced by your readers as opinions on this subject vary intensely between individual users.

E. Bartlett

LONDON, W.C.1

Lighting Power Stations

VALUES OF FLUORESCENT FITTINGS DISCUSSED IN I.E.S. PAPER

OPERATING conditions at power stations require lighting which not only provides adequate general illumination at working areas, but is sufficient for the extra demands of close and accurate working. Moreover, at these positions where higher illumination levels are needed, glare and reflection must be avoided if visual fatigue is to be minimised. For many of these purposes fluorescent lighting would appear to come into its own, being a low surface intensity source of high efficiency and power. Considerable emphasis was made of these useful characteristics in a paper presented to the Illuminating Engineering Society on Tuesday by Mr. P. D. Figgis, who presented an extensive survey of power station lighting.

Boiler house conditions are particularly severe. Although lighting in conveyor and weighing floors is comparatively straightforward, the presence of inter-boiler walkways makes for greater difficulties in the illumination of boiler sides. Along the firing aisle, a level of 10-12 lumens/sq ft may be obtained at the fronts of boilers by fluorescent fittings, either centrally down the aisle for a double row of boilers or along one wall if only a single row has to be illuminated. Methods for the satisfactory illumination of the rear and sides are somewhat more complicated, depending upon the position of the walkways.

The firing aisle at Cliff Quay shown in the heading presents an excellent example of good lighting

At Staythorpe power station the problem is overcome by utilising fluorescent fittings hung vertically down walls or stanchions. To install these fittings a block and winch gear is fitted to the wall and the string of fittings raised one by one, each fitting supplying the one above it and the lowest taking its supply from an adjacent point. Maintenance with this system presents few problems, as the fittings can be just as easily lowered.

This method gives adequate illumination of the rear and sides of boilers from 16 ft to 64 ft above floor level, and was found suitable at Staythorpe where most of the obstructions are vertical. Other methods of space illumination between and behind boilers can be provided by fittings suspended from roof trusses and main inter-boiler walkways. The former provide illumination at drum level and others cover the area successively downwards. Maintenance is relatively straightforward as most fittings will be accessible from walkways. The odd one or two just out of reach can be fitted with hoist equipment and lowered when necessary.

For local walkways individual to each boiler, bulkhead fittings attached to the walkway above are perhaps the most convenient method.

Whatever methods are adopted, however, fittings should be dust tight, or preferably dust free. In this type of fitting reflectors have ventilation galleries to allow the free passage of convection currents, which carry with them most of the dust. The problem of dust appears to a great extent when considering the illumination of ash disposal plant in the basement. For wet ash the problem is small, but for dry ash disposal, especially if it is loaded from hoppers direct into lorries, the dust nuisance can be minimised by employing standard street lighting fittings mounted some distance from the loading point, to give an illumination of 5-6 lumens/sq ft at the working area.

Turning to the heart of the power station, its turbine room, an illumination of 10-12 lumens/sq ft is the satisfactory normal. Providing this lighting from fittings suspended from roof trusses is, however, immediately complicated by the presence of the crane, leaving very little headroom in which to mount fittings. Here, again, the fluorescent lamp can be utilised. But another useful fitting for this location is the combined tungsten and mercury vapour lamp, providing colour blended lighting, which is, for this purpose, considered superior in many ways to tungsten filament sources.

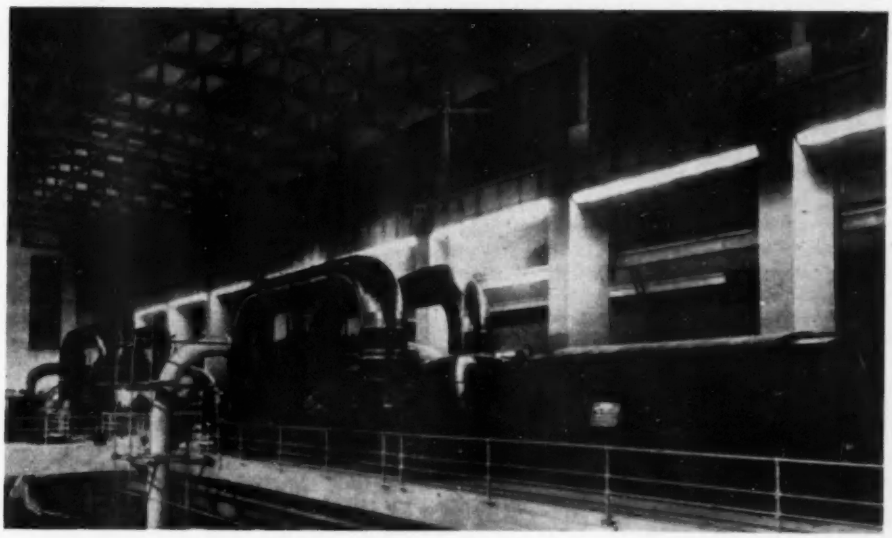
Where, however, the roof is of the barrel type, as opposed to the older lattice steel type, added complications arise when installing roof fittings. In this case it is simpler to use side

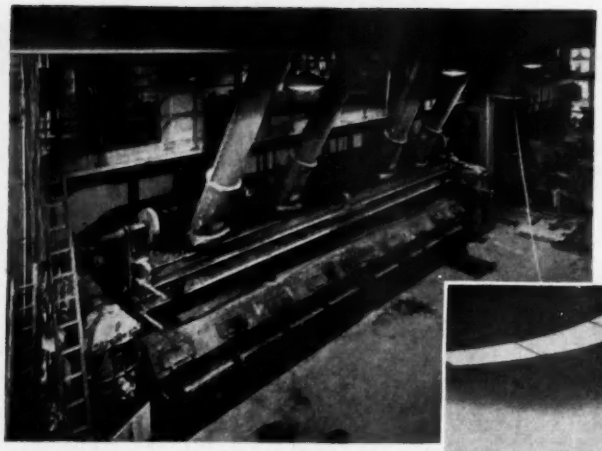
A double row of fluorescent fittings provides adequate lighting in this annexe

lighting from fittings mounted beneath the crane rail. Not only are such sources considerably nearer floor level, but providing angled light distribution they make for the better illumination of vertical surfaces. Once again the fluorescent fitting offers much for this application, but care should be taken, whatever method is used, to ensure that the fitting is as much an integral part of the crane rail as is possible and generally in keeping with its surroundings. The presence of the crane is, for lighting maintenance purposes, a considered advantage, allowing access to fittings mounted either on the roof or below the crane rail.

Despite the importance of adequate turbine house illumination, greater consideration must be given to lighting in the control block and, in particular, to the control room. Here, a higher level of illumination, commensurate

This illustration demonstrates the effectiveness of fluorescent fittings mounted under the crane rail in the turbine house





Left, tungsten filament fittings suspended from overhead catwalks for firing aisle illumination. Below, this photograph of Penistone railway control room shows the pleasing result of mixed direct/indirect lighting

with the closer and more accurate work of the control engineer, is required, amounting to, in some cases, as much as 25-30 lumens/sq ft on the horizontal working level. At the same time, vertical illumination is also required, which introduces a second factor—glare. Considerable attention has, therefore, to be given to the design of control room lighting if working conditions are not to be made over-exacting.

Glare may be either direct from the sources themselves or by reflection from meter faces, and positioning of fittings must be such that neither is present. On the other hand, adequate vertical illumination requires light almost normal to meter faces, but light fittings at this level can become immediately sources of direct or reflected glare. Fittings should be positioned so that the incident angle on meter faces is greater than 20° to 30°, thus avoiding the "danger glare zone," but preferably not more than 45° to 50° if the vertical illumination is to be adequate. Use of low surface brightness lamps, once again the fluorescent tube, alleviates many difficulties.

Ideally indirect lighting is the type best suited for minimum glare and reflection. The high cost of such an installation, its low efficiency and the psychological effect of an over-bright ceiling precludes its adoption in most cases. Provided that walls are light in colour and have a high reflection factor, flush ceiling fittings will, in most cases, be all that is required, reflection from walls providing adequate vertical illumination and sufficient ceiling brightness for a balanced effect.

Considering other sectors of the control block, external switchgear is best illuminated from banks of floodlighting fittings, combined with standard street lighting, a level of 2-3 lumens/sq ft being adequate. Internal switchgear requires somewhat more—6 lumens/sq ft—which can be provided from tungsten filament lamp fittings operated automatically. The annex, being in most cases a long, narrow building, lends itself to a line of fluorescent fittings placed centrally or along the angle of wall or ceiling, depending upon the disposition of electrical equipment, providing a level of 12 lumens/sq ft.

The final aspect meriting attention is that of emergency lighting which forms an indispensable part of a power station installation. Several possibilities are available, of which the most suitable is a completely independent system of tungsten filament lamps operated automatically on failure of the main lighting.

PROBLEMS AND PRACTICE in Engineering

Colour in Control

SERVICING the control panel of an American machine tool, I was very much impressed by the liberal use of colour in the wiring lay-out. All the wiring was on the face of the panel, and the use of coloured wiring would certainly have greatly assisted any electrician engaged on fault-tracing. I could not help but mentally compare this panel with certain control panels of British make. Here, the prime object seems to be to put every obstacle in the way of the maintenance man.

The dominating colour of wire used in many panels in our country seems to be—of all colours—*black*. Why this colour has been chosen, and how it can be reconciled with normal electrical practice, I'm afraid I don't know. When this colour is coupled with wiring on the back of the panel, and the piece of gummed paper with the diagram on has long since vanished, fault-finding is no picnic.

When is some manufacturer going to make a "stay-put" wiring diagram that will withstand the onslaught of oil, steam, water, etc., as these make the use of paper diagrams farcical? Ask any practical electrician you care to—you'll find this is true in most cases. Perhaps some will say that any electrician worth his salt doesn't need colour and diagrams to assist him. This I strongly disagree with. For consider the facts. Designers of circuits may spend weeks, or even months, on a wiring lay-out, and when it is perfected they know that particular circuit upside down. To the electrician, however, it may be only one of many circuits with which he has to deal, and he has to sort out the intricacies in double-quick time! Remember that the one outstanding factor in fault-tracing is to get the wheels turning again as quickly as possible, to which end I think coloured wiring would help.

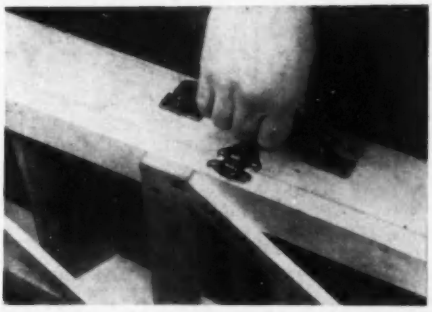
Why *have* we to be so conservative about these things anyway, for after all they would assist in better and surer electrical maintenance? Another angle to this matter is the training of apprentices. It would be far easier to teach a young boy the various paths of an electric current by colour, than by having him attempt to follow a dreary succession of black wires.

Making things too easy? BOSH!

Take a simple direct-on starter. We could have distinctive colours for the initial start c.c.t., the "holding" c.c.t., and the coil c.c.t. up to a point. Mains wires would also have their own colours, and also "remote" connections. Terminals would be marked with fixed tags, not the loose ones that some firms favour. The more complicated panels could be coloured and numbered in a similar manner. All these things would help to keep the wheels turning longer, and make the electrician's life pleasanter. Have we always to be behind "Uncle Sam"?—*J. Wilkins.*

Step out with the Steps

SOME of our maintenance electricians are constantly burdened with "steps," tool boxes, and coils of cable as they travel around from one working station to another. We found that the load could be carried much more easily if the two heaviest items were balanced, i.e. the tool box in one hand and the steps in the other, the shoulder being reserved for cable.



Step-ladder carrying made easy with suitcase fittings

In order to rationalise the carrying of steps we first screwed on a common suit-case handle at a central point in the length of the steps—the weight being distributed evenly on either side. This provided a very convenient means for carrying the steps but something had to be done to prevent the legs of the steps swinging open during transit. A further suit-case fitting in the form of a snap catch was accordingly screwed on to the steps, as illustrated. The catch holds the steps in a closed position until they are required for use and has proved to be a very useful fitting, making the steps easier to handle in all situations.—*C. T. Bower.*

The Heat Pump

— ITS HISTORY AND POTENTIALITIES

IMMEDIATELY after the war, considerable interest was shown, both in this country and in the United States, in the potentialities of the heat pump. In actual fact, as was pointed out by Mr. J. A. Sumner in a paper read before the Midland Section of the Institute of Fuel last April, the concept of the heat pump goes back to early part of the 19th century, when Carnot presented the conditions of working for an ideal engine and showed that this cycle was reversible. The upgrading of heat, however, was shown to be less efficient than the direct downgrading of heat to produce mechanical energy. Dr. Joule (1851) suggested the principle of a practical machine and a year later Bell-Coleman produced a refrigerator based on the reversed Joule cycle, using air as a working substance. In the same year, Lord Kelvin emphasised the important fact that a refrigerator of the Bell-Coleman type could also act as a "warming" machine and that the amount of heat transferred from the "cold" to the "hot" side could be much greater than the amount of energy needed to effect the transfer. It was not, however, until 1929 that the concept began to be realisable in a practical form by Haldane, who constructed a small experimental plant. A second hiatus ensued, until in 1945 an experimental large scale plant was installed at Norwich, to be followed by a further installation in the Festival Hall. Both these plants have been described in the Technical Press.

Thermodynamic Considerations

A difficulty, which has proved troublesome to many people interested in heat pumps, is that of defining the ratio "energy delivered/work done in driving the pump". In this connection it is important to differentiate between the refrigerator and the heat pump. The most efficient refrigerator is one which, for a given expenditure of mechanical work, abstracts the greatest amount of heat from a body to make it colder. The standard method of defining this ratio for a refrigerator is :

$$\frac{\text{Heat abstracted}}{\text{Work expended}} = \frac{T_2}{T_1 - T_2} = \text{Coeff. of performance}$$

The heat pump, on the other hand, is most efficient when it delivers the greatest amount of heat for a given amount of energy put in to operate the machine; and the method of defining this ratio is given by the following formula.

$$\frac{T_1}{T_1 - T_2} \text{ or } 1 + T_2/(T_1 - T_2)$$

It is thus suggested by Mr. Sumner that the term "coefficient of performance" should be restricted to the operation of the refrigerator. For the heat pump, the term "reciprocal thermal efficiency" (R.Th.E.) should be used.

Practical Use

When it comes to the practical use of heat pumps, much research is being carried on in the United States, and a somewhat lesser amount in this country, although the question of fuel saving is of greater importance in Great Britain. In general, heat pump design has followed refrigerator practice using the vapour compression machine and many improvements are possible, providing research is directed toward this specific object. It might, in fact, be practicable to provide efficient and economical space heating through the medium of a small domestic heat pump.

Industrially, there are many applications worthy of consideration, particularly where hot water for process work or space heating is required; and in such cases the heat pump may often achieve greater savings than that derived from the normal pass-out turbine system. There are, however, distinct limitations—chiefly concerned with terminal temperatures—which require each case to be dealt with on its own merits.

An assessment of the economic aspects of the heat pump has been given by H. L. Dawson, who emphasises that when used for space heating it is of prime importance—owing to the high capital cost of the installation—to keep the plant working as near full load as possible during the heating season. A method of doing this is to arrange matters so that the heat pump takes the base load, and extra heat is provided when necessary by other means. To determine the heat demand through the season it is necessary to calculate the degree day units in the locality. From this it is possible to derive an optimum value of heat pump capacity which would lead to the most economical working.

An example of the application of this method to a practical case is given in the January issue of the *Journal of the Institute of Fuel.*

NETWORK CALCULATIONS

Using the theory of symmetrical components for calculating the electrical characteristics of arc suppression coils in distribution networks

By A. SALZMANN, Dipl.Ing., A.M.I.E.E.

WHEN planning system protection by Petersen coils, it is essential to determine: first, the size of the coil, range of the coil reactance, number of the coils and their locations; secondly, we require the magnitude of the 50 cycle current in the fault; third, is the over-voltage values of the system during fault periods; and finally is the coil performance found by the switching out of feeders without coil retuning.

These problems can be solved by application of symmetrical components introduced by the late Dr. C. Fortescue.[1] For instance, in obtaining in advance the magnitude of the 50 cycle in-phase component of the fault current, proof of the effectiveness of the arc-suppression coil can be established. This applies particularly to extra high-voltage networks with large in-phase current components due to corona.

Calculation of the magnitude of the reactive component of the fault current is also essential. This component is equal to the difference between lagging coil and leading capacitive currents and is caused by imperfect tuning of the coil, caused by the switching out of feeders. As far as an arcing earth fault is concerned a large reactive component may affect the arc-quenching characteristic of the coil, as the magnitude of the consequent current may be sufficient to maintain the arc.

The magnitude of the 50 cycle voltages to earth of two healthy phases at points remote from the fault should also be determined in advance, in order to ascertain that over-voltages under fault conditions in systems with long transmission lines do not exceed the permissible value and are within the insulation strength of the connected equipment. This investigation is of utmost importance as such expedients as shifting the coil from the point of supply to the sub-stations in the network, or, alternatively increasing the number of coils are remedies to reduce over-voltages at points distant from a possible fault.

Petersen coils are set to pass, in the event of a fault, a reactive current equal to the total capacitive current of the transmission system when one phase is earthed. Actually, the effect of an earth fault is to superimpose on the existing voltages of all conductors a voltage $(-V)$ equal in magnitude, but opposite in phase, to the line-to-earth voltage $(+V)$ prior to the fault. The voltage of the faulty phase becomes therefore approximately zero, while that of the healthy phases increases from V to $\sqrt{3} \times V$. The capacitive current of each healthy phase thus rises to $\sqrt{3}$ times the pre-fault value, and the resultant capacitive current flowing in the fault becomes three times the value of one phase, prior to the fault.

By making the coil reactance equal to the distributed capacitive reactance to earth, a current driven by the voltage $(-V)$ neutralises the capacitive current flowing from the healthy phases to earth in the fault. Actually the current flowing in the fault is not completely compensated. The latter consists of a reactive and in-phase components. The reactive component is due to the deviation from resonance in the tuning of the arc-suppression coil, and the in-phase or wattful component is due to the resistance loss in the coil, resistance loss in the transmission line, leakage over the insulators and the corona loss; the latter varying with the weather. This component cannot be compensated; nevertheless methods have been developed to compensate the in-phase component, but they are very complicated and proved uneconomical.

Coil Reactance [2]

Let us consider the circuit shown in Fig. 1 with a line-to-earth fault, say, on the red phase, at the location "F." The appropriate sequence impedance networks are shown in Fig. 2. As a first approximation the reactance X_p of the coil connected to the transformer neutral can be determined as follows.

According to the theory of symmetrical components, the zero phase reactance between the neutral of the transformer and earth is equal to three times its actual value $(+jX_{po})$. The reason for this is that the zero phase sequence current I_{po} must flow through $3 \times (jX_{po})$ in

order to produce the same voltage across the neutral reactance as the fault current, the latter being equal to three times the zero-phase sequence current.

Neglecting the system losses and line impedance it is clear that the zero-phase sequence capacitive current in the fault is neutralised by the zero-phase sequence reactive current passed by the arc-suppression coil if the zero-phase sequence capacitive reactance ($-jX_{co}$) is equal to $-jX_{co}=+j(3X_{po}+X_{To})$ where X_{To} is the zero-phase sequence reactance of the transformer.

The actual reactance of the coil is therefore

$$X_{po}=1/3(X_{co}-X_{To}) \quad \ldots\ldots\ldots\ldots (1)$$

and the total zero-phase sequence reactance viewed from the point of fault is

$$X_o=\frac{(-jX_{co})(3jX_{po}+jX_{To})}{-jX_{co}+3jX_{po}+jX_{To}}=\infty \quad \ldots\ldots\ldots (2)$$

Under these conditions theoretically no current will flow in the fault as the phase-sequence currents $I_1=I_2=I_0$

$$=E/(X_1+X_2+X_0)=E/(X_1+X_2+\infty)=0. \quad \ldots (3)$$

are zero. In this formula X_1 represents the positive phase-sequence reactance, X_2 the negative, X_0 the zero viewed from the fault and E the phase to neutral e.m.f. of the source of supply. Thus, under ideal conditions, neglecting line impedance and system losses, the current in the fault in the positive, negative and zero-phase sequence network is zero, and in the zero-phase sequence network (Fig. 2c) will flow a leading capacitive current to the right of the point of fault and lagging reactive current to the left. It is therefore justifiable to consider only the zero-phase sequence network when determining to a first approximation the reactance of the coil.

Effect of Other Losses

However, when taking line impedances and system losses into consideration, the fault current given by

$$I_F=3I_o=3I_1=3I_2$$

$$=3E/(Z_o+Z_1+Z_2) \quad \ldots\ldots\ldots\ldots\ldots (4)$$

is not zero as the resultant zero-phase sequence impedance is not infinite. The zero-phase sequence capacitive current to the right of the fault (see Fig. 2c) is

$$I_{co}=E_o/Z_{co} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where E_o = the zero-phase sequence voltage and Z_{co} = the total impedance to the right of "F." The zero-phase sequence current through the arc-suppression coil to the left of the fault is

$$I_{po}=E_o/(3r_{po}+j3X_{po}+jX_{To}) \quad \ldots\ldots\ldots\ldots (6)$$

where r_{po} = resistance of the coil; X_{po} = reactance of the coil; X_{To} = zero-phase reactance of the transformer and the coil current is equal to $3\times I_{p_0}$; as the coil carries the zero-phase currents from all three conductors. It is of interest to note that the losses in the coil have not been neglected. The coil resistance should be as high as is practically possible to operate a wattmetric earth-fault indicating relay, if required, in event of a line to earth fault. Thus the continuous rating of the coil is obtained from

$$3I_{po}\{3I_{po}(r_{po}+jX_{p_0})\} \quad \ldots\ldots\ldots\ldots\ldots (7)$$

where the term

$$3I_{p_0}(r_{p_0}+jX_{p_0}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

represents the voltage applied across the coil.

As regards the range of the coil reactance, the minimum reactance is to be determined for the worst conditions, namely for a fault adjacent to the point of supply with the total length of line in the circuit. At this point the fault current has its maximum value, resulting in a maximum current in the coil and the lowest coil reactance, together with possible over-voltages at the remote end of the system in excess of the rated voltage value. (See example and Table 2.) The maximum reactance of the arc-suppression coil is determined by the length of the transmission line required to remain permanent in the circuit such as section "a" (see Table 2).

Tuning, Fault Current, Neutral Displacement Voltage and System Losses [3, 4]

Let us consider the zero-phase sequence network (Fig. 2c). Ignoring the positive and negative sequence networks (they have a negligible effect on the magnitude of the fault current, as is shown by the example), but taking into consideration the leakage over insulators and

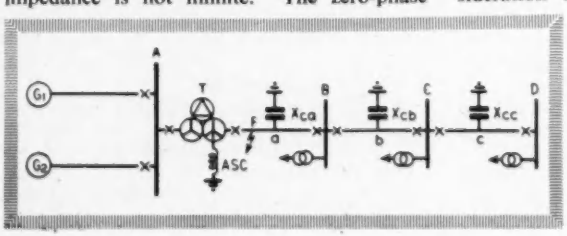


Fig. 1. Single line diagram of a power transmission system protected by an arc-suppression coil

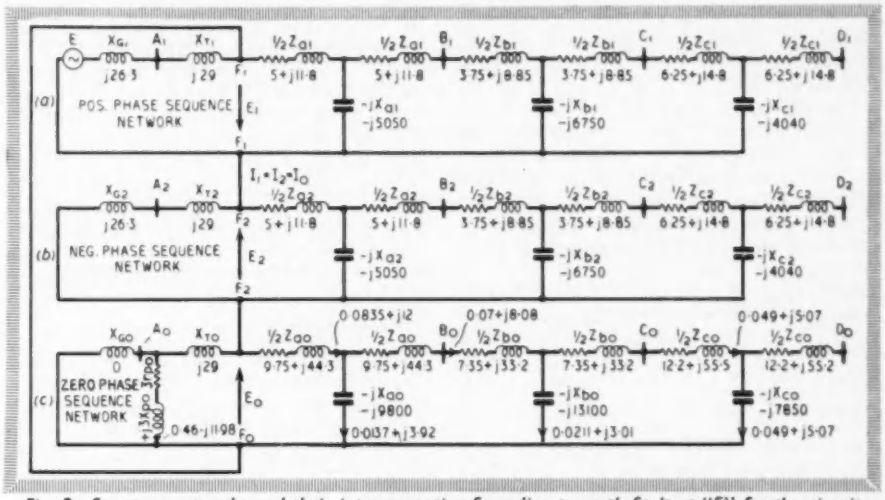


Fig. 2. Sequence networks and their interconnection for a line to earth fault at "F" for the circuit shown in Fig. 1

equipment represented by "R," the simplified diagram is shown in Fig. 3. Viewing the circuit from the point of fault, a parallel circuit is established, and it follows that the zero-phase sequence current for a zero-impedance fault is

$$I_{Fo}=E_o\left(\frac{1}{3r_{po}+j(3X_{po}+X_{To})}+\frac{1}{R_{co}-jX_{co}}+\frac{1}{R}\right) \quad (9)$$

This equation can be written in the form

$$I_{Fo}=E_o(a+jb) \quad (10)$$

where

$$a=\frac{3r_{po}}{(3r_{po})^2+(3X_{po}+X_{To})^2}+\frac{R_{co}}{(R_{co}^2+X_{co}^2)}+\frac{1}{R} \quad (11)$$

and

$$b=j\frac{X_{co}}{(R_{co}^2+X_{co}^2)}-\frac{(3X_{po}+X_{To})}{(3r_{po})^2+(3X_{po}+X_{To})^2} \quad (12)$$

Thus the earth-fault current consists of two components, the in-phase component (aE_o) and the quadrature component (jbE_o), displaced by 90° from each other. Under resonant conditions (perfect tuning) the "j" term in equation (10) vanishes and only the real term remains. Notice that in equations (11) and (12) the term $(3r_{po})^2$ is small as compared with $(3X_{po}+X_{To})^2$, also R_{co}^2 is very small in relation to X_{co}^2. Substituting, therefore, for $X_{po}=1/3(X_{co}-X_{To})$ (resonant conditions, see equation (1)), and for

$$E_o=I_{co}\sqrt{R_{co}^2+X_{co}^2}\simeq I_{co}X_{co} \quad (13)$$

in (10), (11), (12), and neglecting $(3r_{po})^2$ compared to $(3X_{1o}+X_{To})^2$, and also R_{co}^2 compared to X_{co}^2, we obtain the zero-phase sequence fault current

$$I_{Fo}=\frac{I_{co}^2}{E_o}(3r_{po}+R_{co})+\frac{E_o}{R} \quad (14)$$

and the total fault current becomes

$$I_F=3I_{Fo} \quad (15)$$

It is apparent that the magnitude of the fault current is determined by the leakage resistance R and the losses of the capacitive current I_{co} in the resistances $(3r_{po}+R_{co})$ of the system. With a larger resistance of the coil, required for operation of the earth fault indication relays and increased length of the line, the fault current becomes larger.

For a dissonant tuned coil I_F is further increased by the reactive component (jbE_o), due to deviation from resonance, and the arc-suppression coil may lose its arc quenching characteristic if the current exceeds a value specified by the makers. Thus, the minimum fault current is determined by perfect tuning and small system losses.

However, under normal operation conditions, resonance tuning, particularly for medium voltage systems, has disadvantages. These are due to the fact that it increases the neutral displacement voltage, which results in permanent stress on the system insulation and also gives undesirable continuous current through the coil. Small system losses are also responsible for a larger neutral displacement voltage.

The proof of these statements can be established as follows:—

It is well known any asymmetry of the system, such as unequal capacitance to earth, develops a small voltage E_N between the neutral point of the supply system and earth. Although

this voltage can be reduced by complete transposition of the overhead lines and sometimes by employing shunt capacitors, E_N cannot be reduced to zero.

Considering the simplified circuit as in Fig. 4, in which the total capacitive reactance of the system is represented by $-jX_c$, leakage over insulators and apparatus by R, system resistances by R_c and the coil resistance and reactance by r_p+jX_p. Solving this series circuit by

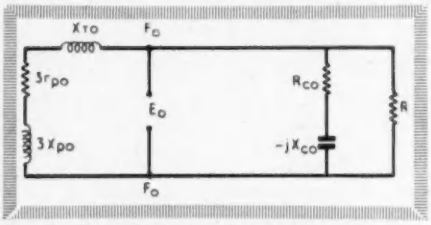


Fig. 3. Equivalent zero-phase sequence network viewed from the fault

the straightforward method, the current driven by the voltage E_N is equal to

$$I_N=[E_N/(r_p+R_c+jX_p)]+(E_N/Z_1) \quad \ldots\ldots\ldots(16)$$

$$\text{where } Z_1=\left[\frac{X_c^2}{R}-jX_c\right] \quad \ldots\ldots\ldots\ldots\ldots(17)$$

Z_1 represents the impedance of the parallel circuit containing ($-jX_c$ and R). This current flows from earth through the coil to the star point (see Fig.1), thus producing a neutral displacement voltage under normal operation conditions with the magnitude

$$E_D=I_N(r_p+jX_p) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(18)$$

Combining (16), (17) and (18), we obtain

$$E_D=\frac{E_N(r_p+jX_p)}{[(r_p+R_c+(X_c^2/R)]+j(X_p-X_c)} \quad \ldots\ldots(19)$$

From this equation, it is apparent that perfect tuning $X_p=X_c$ (series resonance) causes a maximum neutral displacement voltage. A large asymmetrical voltage E_N prior to the connection of the coil, small resistances of the system and a large value of R (good insulated network) have also the tendency to increase the neutral displacement voltage E_D. Summing up, the earth fault current and neutral displacement voltage depend on the same parameters (system losses and tuning), but they have an opposite effect on the coil performance. In order to reconcile these contradictory requirements, such as resonance tuning and small displacement voltage, a compromise must be effected by operating the coil at dissonance tuning, particularly for medium-voltage networks (corona loss zero). Experiments have proved that a deviation from resonance up to +20% for medium-voltage networks has little effect on the arc-extinction ability of the coil.

Application

The single-circuit three-phase transmission line without overhead earth wire shown in Fig. 1 is to be protected by an arc-suppression coil connected between the star point of the transformer and earth. The system data are given in Table 1, and it is assumed that corona losses are negligible. It is required to determine—

(*a*) Fifty-cycle fault current for a line-to-earth fault adjacent to the point of supply.

(*b*) Continuous coil rating.

(*c*) Impedance range of the arc-suppression coil.

(*d*) Magnitude of the voltages at the remote end of the transmission line.

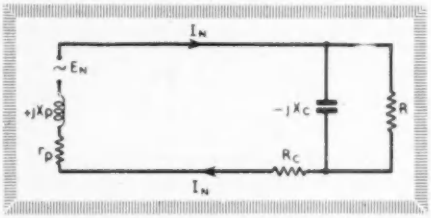


Fig. 4. Equivalent circuit viewed from the neutral

Solution

Line series impedance. Cross sectional area 0·175 sq in.; resistance R=0·25 ohm/mile from tables given by the manufacturers. Posi-

TABLE I—SYSTEM DATA OF THE TRANSMISSION SCHEME SHOWN IN FIG. 1

	Rated output MVA	Rated voltage kV	Length miles	Sequence impedances—ohms*			Sequence capacitive reactances—ohms*		
				Positive	Negative	Zero	Positive	Negative	Zero
G†	10	11	—	*j*52·5	*j*52·5	*j*36	—	—	—
G_2†	10	11	—	*j*52·5	*j*52·5	*j*36	—	—	—
T‡	15	11/66	—	*j*29	*j*29	*j*29	—	—	—
Line a§	—	66	40	10+*j*23·6	10+*j*23·6	19·5+*j*88	−*j*5,050	−*j*5,050	−*j*9,800
Line b§	—	66	30	7·5+*j*17·7	7·5+*j*17·7	14·7+*j*66·2	−*j*6,750	−*j*6,750	−*j*13,100
Line c§	—	66	50	12·5+*j*29·6	12·5+*j*29·6	24·4+*j*111	−*j*4,040	−*j*4,040	−*j*7,850

*Referred to 66 kV. †12% reactance. ‡10% reactance. §Steel core aluminium. Distance between conductors 86/86/72 in. Height above ground 27 ft 6 in.

tive and negative phase-sequence reactances are obtained from
$X_1=X_2=4{\cdot}66f\times10^{-3}\log_{10}(GMD/0{\cdot}826r)$ ohm/mile [5.] where "GMD" is the geometric mean distance
$=\sqrt[3]{86\times86\times172}=108$ in.; f=50 c/s, and r=overall radius and equal to 0·385 in. Substituting these values, we obtain $X_1=X_2=0{\cdot}59$ ohms, and the line impedances $Z_1=Z_2=0{\cdot}25+j0{\cdot}59$ ohms per mile.

Zero-phase sequence impedance is obtained from
$Z_o=R+4{\cdot}77f\times10^{-3}+j14f\times10^{-3}\log_{10}(D_e/D)$ [5.]
where D_e=depth of the current below the surface and equal, according to Carson, to

$D_e=216\sqrt{\rho/50}=216\sqrt{10{,}000/50}=3{,}050$ft;

ρ=resistivity in ohm per cm/cube=10,000, and $D=\sqrt[9]{(0{\cdot}826r)^3\times86^2\times86^2\times172^2}=2{\cdot}15$ ft. Substituting these values in the above equation, we get $Z_o=0{\cdot}488+j2{\cdot}21$ ohms/mile.

Shunt capacitance, reactance. Positive and negative phase sequence reactances are given by the formulae
$X_{c1}=X_{c2}=0{\cdot}08187\times\log_{10}GMD/r$
$=0{\cdot}08187\times\log_{10}(108/0{\cdot}385)$
$=0{\cdot}202$ megohm/mile;
and the zero-phase sequence capacitance reactance is given by

$$X_{co}=0{\cdot}08187\times\log_{10}\frac{8\times h_1\times h_2\times h_3}{r\sqrt[3]{86^2\times86^2\times172^2}} \quad [6.]$$

where h_1, h_2, h_3 are the heights of the conductors above ground and equal to, say, 27 ft 6 in. Substituting these values, we obtain $X_{co}=0{\cdot}392$ megohms per mile.

The total capacitance can be considered lumped at the centre of each section (T line), and we get
Section (*a*) $-jX_{a1}=-jX_{a2}=-j0{\cdot}2\times10^6/40=-j5{,}050$ ohms.
Section (*a*) $-jX_{ao}=-j0{\cdot}392\times10^6/40=-j9{,}800$ ohms.
Section (*b*) $-jX_{b1}=-1jX_{b2}=1-1j6{,}750$ ohms $-jX_{bo}=-j13{,}100$ ohms.
Section (*c*) $-jX_{c1}=-jX_{c2}=-j4{,}040$ ohms $-jX_{co}=-j7{,}850$ ohms.

Fault Current

Reducing the impedances of the zero-phase sequence network right of the fault (Fig. 2c), we obtain
$Z_{co}=20{\cdot}95-j3{,}176$
$=3{,}176\angle89{\cdot}6^\circ$ ohms,
hence the "*j*" term (3,176 ohms) is used to determine the reactive ohms of the arc-suppression coil. Substituting in equation 1 for $X_{To}=j28{\cdot}9$ the coil reactance is equal to $X_{po}=j1/3(3{,}176-28{\cdot}9)=+j1{,}049$ ohms.

Assuming 4% coil losses, and at first approximation a coil current of 37 amp, the resistance is
$r_{po}=0{\cdot}04(66{,}000/\sqrt{3}\times37)=41$ ohms;
and coil impedance
$Z_{po}=r_{po}+jX_{po}=41+j1{,}049$
$=1{,}049\angle87{\cdot}8^\circ$ ohms.

Fault current. From equation (4)
$I_F=3I_1=3I_2=3I_o=3\times E/(Z_1+Z_2+Z_o)$
where Z_o=the total zero-phase sequence impedance determined by paralleling the impedances to the right and to the left viewed from the fault, and this is equal to

$$Z_o=\frac{Z_{co}\times((3\times Z_{po})+X_{To})}{Z_{co}+(3\times Z_{po})+X_{To}}$$
$$=\frac{3{,}176\angle89{\cdot}6^\circ\times3{,}176\angle87{\cdot}8^\circ}{144\angle0^\circ}$$
$=69{,}700\angle1{\cdot}8^\circ$ ohms.

In similar manner we obtain $Z_1=Z_2=$the total positive and negative phase sequence impedances viewed from "F" (see Fig. 2a and 2b). Impedances to the right of the fault are $10{\cdot}8-j1{,}648=1{,}648\angle89{\cdot}6^\circ$ ohms, and to the left are $j(26{\cdot}3+29)=j55{\cdot}3$ ohms. Hence

$$Z_1=Z_2=\frac{55{\cdot}3\angle90^\circ\times1{,}648\angle89{\cdot}6^\circ}{1{,}593\angle89{\cdot}6^\circ}$$
$=57\angle90^\circ$ ohms.

Substituting these values in equation (4), we get
$I_{fo}=I_1=I_2=I_o=$
$=(66{,}000/\sqrt{3}\angle0^\circ)/(69{,}700\angle1{\cdot}8^\circ+57\angle90^\circ+57\angle90^\circ)$
$=0{\cdot}547\angle1{\cdot}7^\circ=0{\cdot}547+j0{\cdot}0182$ amp,
and the fault current is then
$I_F=3\times I_o=1{\cdot}641\angle1{\cdot}7^\circ$ amp.

In the positive and negative sequence networks left from "F" the current flow is
$(0{\cdot}547\angle1{\cdot}7^\circ\times1{,}648\angle89{\cdot}6^\circ)/(10{\cdot}8-j1{,}648+j55{\cdot}3)$
$=0{\cdot}575/1{\cdot}7^\circ$ amp,
and to the right of the fault is
$0{\cdot}575\angle1{\cdot}7^\circ-0{\cdot}547\angle1{\cdot}7^\circ\simeq0{\cdot}0189$ amp.
Consequently the current in the positive and

TABLE 2—IMPEDANCE, CURRENT AND FAULT CURRENT FOR LINE SECTIONS

	Section	Coil impedance ohms	Coil current amps	Fault current amps	Tuning
1	a, b, c	$41+j1{,}049$	$1{\cdot}38-j36$	$1{\cdot}64+j0{\cdot}05$	Resonant
2	a, b	$41+j1{,}842$	$0{\cdot}465-j20{\cdot}52$	$0{\cdot}489+j0{\cdot}0103$	Resonant
3	a	$41+j3{,}242$	$0{\cdot}142-j11{\cdot}7$	$0{\cdot}159+j0{\cdot}00195$	Resonant
4	a, b	$41+j1{,}049$	$1{\cdot}38-j36$	$1{\cdot}425-j15{\cdot}36$	Dissonant
5	a	$41+j1{,}049$	$1{\cdot}38-j36$	$1{\cdot}38-j23{\cdot}94$	Dissonant
	1	2	3	4	5

negative sequence networks right of the fault are negligible. In general the fault current is slightly higher than the calculated value if allowances are made for leakage of the insulators and equipment and currents of higher harmonics.

Coil Rating

From the principle of symmetrical components the sequence voltages at the fault location are

$E_1 = E - I_1 Z_1$ .....(20)

$E_2 = 0 - I_2 Z_2$ .....(21)

$E_o = 0 - I_o Z_o$ .....(22)

and line-to-earth voltages

$E_r = E_1 + E_2 + E_o = 0$ .....(23)

(E_r = zero with zero fault impedance.)

$E_y = E_o - 1/2(E_1 + E_2) + j0{\cdot}866(E_1 - E_2)$ ....(24)

$E_b = E_o - 1/2(E_1 + E_2) - j0{\cdot}866(E_1 - E_2)$ ....(25)

Substituting in these equations the values given earlier, we obtain

$E_1 = (66{,}000/\sqrt{3}) - 0{\cdot}547 \angle 1{\cdot}7^\circ \times j57 \simeq 38{,}200 - j31{\cdot}2$ V.

$E_2 = 0 - 0{\cdot}547 \angle 1{\cdot}7^\circ \times j57 \simeq -j31{\cdot}2$ V.

$E_o = -(E_1 + E_2) = -38{,}200 + j62 \simeq 38{,}200$ V.

It is apparent from these equations that the magnitude of the zero-phase sequence voltage required for the coil rating is approximately equal to line-to-neutral voltage.

Coil current. Zero-phase sequence capacitive current, right of the fault is, from equation (5),

$I_{co} = 38{,}200 \angle 0^\circ / Z_{co} = 38{,}200 \angle 0^\circ / 3{,}176 \angle 89{\cdot}6^\circ = 12 \angle 89{\cdot}6^\circ = 0{\cdot}0835 + j12$ amp.

Zero-phase sequence current through the coil left to the fault is, from equation (6),

$I_{po} = 38{,}200 \angle 0^\circ / (3Z_{po} + jX_{To}) = 38{,}200 \angle 0^\circ / 3{,}176 \angle 87{\cdot}8^\circ = 12 \angle 87{\cdot}8^\circ = 0{\cdot}46 - j11{\cdot}98$

As a check:

$I_{po} + I_{co} = 0{\cdot}46 - j11{\cdot}98 + 0{\cdot}0835 + j12 = 0{\cdot}543 + j0{\cdot}02$

which agrees approx, with $I_{fo} = 0{\cdot}547 + j0{\cdot}0182$ amp.

Total coil current:

$3I_{po} = 3 \times 12 \angle 87{\cdot}8^\circ = 36 \angle 87{\cdot}8^\circ$ amp,

against 37 amp at a first approximation.

Coil rating. From equation (8) the coil rating is

$3I_{po} \times (3I_{po}(r_{po} + jX_{po})\ 10^{-3} = 3 \times I_{po} E_o \times 10^{-3} = 312 \angle 87{\cdot}8^\circ \times 38{,}200 \times 10^{-3} = 1{,}370 \angle 87{\cdot}8^\circ$ kVA.

System Over-Voltage

The voltage at the remote end from the point of supply, with an arc-suppression coil located adjacent to the source of supply, can be determined as follows:—

At point "D" the positive and negative phase sequence voltages E_1 and E_2 are approximately the same as at "F" and equal to $E_1 = 38{,}200 - j31{\cdot}2$ V; $E_2 = -j31{\cdot}2$ V. This is justified, since the currents in the positive and negative sequence networks right of the fault are negligible. The zero-phase sequence voltage, however, is not identical to that at point "F" and is obtained from equation (22).

Substituting for $I_o = 0{\cdot}049 + j5{\cdot}07$ amp (notice the current distribution in the zero sequence network can be easily determined—see Fig. 2c) and for $Z_o = -j7{,}850$ ohms, we obtain

$E_o = 0 - I_o Z_o = 0 - (0{\cdot}049 + j5{\cdot}07)(-j7{,}850) = -39{,}800 + j384$ V.

The line-to-earth voltage on the faulty phase is

$E_r = E_1 + E_2 + E_o = -1{,}600 + j321{\cdot}6$ V.

While line-to-earth voltages on the healthy phases are

$E_y = -39{,}800 + j384 - 19{,}100 + j31{\cdot}2 + j0{\cdot}866 \times 38{,}200 = 69{,}000 \angle 148{\cdot}8^\circ$ V.

$E_b = -39{,}800 + j384 - 19{,}100 + j31{\cdot}2 - j33{,}100 = 67{,}700 \angle 209{\cdot}1^\circ$ V.

(See equations (23), (24) and (25).)

From these calculations it is apparent that the voltages on the healthy lines at point 120 miles away from the fault are higher than the voltages at the fault location. However, if these voltages are exceeding the permissible value, the coil should be shifted nearer to substation "B" or "C," provided neutral points are available for the connection of the coil. This follows from Fig. 2c. By shifting the coil away from the point of supply toward the remote end of the transmission system, the lagging current from the coil has to flow into the system, thus will balance the leading capacitive current from the line flowing through the line impedance. This results in a decrease of the capacitive current and consequently reduction of the voltage on the healthy phases at the remote end as large current will not flow through the line.

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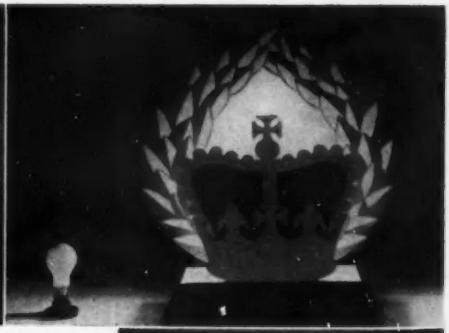
Home-made Coronation Displays

—SOME SIMPLE DESIGNS WITHIN THE CAPABILITIES OF THE HANDYMAN ARE SUGGESTED BY THE ELECTRIC LAMP MANUFACTURERS' ASSOCIATION



These photographs show some simple ideas for Coronation lighting. The one above consists of two pieces of plywood pinned together, the lower being covered with red flock paper with the letters cut out. Plywood is also used for the top right, the crown and laurel being separate with the lamp between. On right is a cardboard hoop with paper sculptured roses, and two semi-circular architectural decoration lamps. Below left, sculptured roses are used again with decoration lamps, and bottom right is a more elaborate display using circular fluorescent lamps with bands of cinemoid. Full details may be obtained from the Lighting Service Bureau, 2 Savoy Hill, London W.C.2

overseas news

Water for Canadian Use

The Canadian Resources Minister, Mr. Winters, has rejected the application of the Aluminum Co. of America for permission to provide power for a large American project in Alaska. Mr. Winters has made it clear to the company, apparently, that the Canadian Government's responsibility is to see that the waters are utilised for the maximum benefit of Canadians. The $400 million plan put forward by the Aluminum Co. of America proposed the construction of a large dam on the Yukon River to block the flow and create a reservoir, from which water would pass through two large tunnels under the Chilkoot Pass with two 800,000 h.p. underground power houses in the mountainside near Skagway. It was anticipated that an annual output of 200,000 tons of aluminium could be obtained.

Crompton Parkinson in Canada

It is reported from Toronto that Crompton Parkinson Ltd. has purchased a site of 27 acres on the outskirts of Brantford, Ontario. Here it is proposed to construct a factory with an area of approximately 25,000 sq. ft., it is stated. From the London office of the company it has been stated that plans for the development of the site have not yet been completed.

Blow to Saskatchewan

After 16 months of studying all the necessary data a three-man Royal Commission has now reported that it would not be justified in recommending immediate construction of the South Saskatchewan power and irrigation scheme. Cost seems to have been the chief reason for the Commission's negative finding. In 1947 the cost of the scheme was put at $150 million, but the Commission, who put the cost at $250 million, found that the previous estimate had omitted various important costs. This high cost the Commission considers too great when weighed against the economic and social returns which the project might be expected to bring the country as a whole. The original scheme envisaged the damming of the South Saskatchewan River so as to create an artificial lake some 135 miles long. This would provide much-needed irrigation and about 435,000 kW of power—one and a half times as much as Saskatchewan now has. The report has deeply shocked many people in the province, it would seem. When the Commission was appointed in August, 1951, Prime Minister St. Laurent said it had been instructed to report on whether the economic and social returns to the Canadian people would justify the investment needed for the project. Chairman of the Commission was Dr. T. H. Hogg.

Canada's Nuclear Energy Plant

A new heavy water reactor is being built at the Canadian Government's nuclear energy project at Chalk River, Ontario. This is being erected beside the smaller of the other reactors on the south bank of the Ottawa River, on the secluded site acquired some time ago by the Government. Various precautions are in force, the concentrated working part of the plant being strongly fenced. The smaller reactor, which has been in use for about five years, is again out of action, but fortunately no one was injured in the mishap last month and little damage was done, it is reported. Men are able to remain under the reactor for only a few minutes, and a television camera has now been installed to enable the most to be made of the limited spells of repair work.

Toronto's Changeover

Downtown Yonge Street, one of the busiest commercial streets in Toronto, will be the first section of Toronto to be dealt with under the Hydro Electric Power Commission's plan to change over to the 60-cycle system. Tentative schedules for the work provide that the 802 commercial premises and 211 domestic and power accounts in this area will switch to 60 c/s in the spring of 1954. With the initial operation of the Yonge Street subway scheduled for a few months before that time, Mr. Saunders, chairman of the Commission, has termed the change-over Yonge Street's second major face-lifting within a short period. Crews are moving into the area this month to start the preliminary work of listing all frequency-sensitive electrical equipment. This job will take about two months to complete. There is one other improvement resulting from the operation. New underground ducts and cables are to be installed before new pavement is laid above the subway.

Plant for Norway

The first 37,500 kVA generator, made by the Metropolitan-Vickers Electrical Co. Ltd. for the Aura hydro-electric station at Sunndalsoren, Norway, left Manchester Docks a few days ago. Earlier reference was made to this machine in our issue of November 27, page 990. The arrival of the generator will be a big event for Norwegians, as the power station has been under construction since 1914. For various reasons work has been held up, and when, during the occupation, Germans took over, partisans sabotaged their work. A further generator will be shipped in March, and four others are also under construction.

Registration in S.A.

The Union of South Africa is the latest to propose the introduction of a scheme for controlling the activities of electric wiring contractors. It is apparently intended to introduce a system of registration of contractors and of wiremen much on the lines of the scheme applying in New Zealand. In this connection a sub-committee has now circularised a final draft of the proposed regulations, inviting observations and comments. Among the various provisions so far proposed, it is stipulated that electrical contractors shall possess and maintain in good condition a wide range of tools and equipment, and that they shall have premises suitable and adequate for carrying on the business.

Problem in Israel

The question of raising capital to provide for the establishment in Israel of new power stations was one of the reasons for the brief visit to London last week of Mr. A. Rutenberg, managing director of the Palestine Electric Corporation Ltd. He intends to return for a longer stay at the end of this month, when he may also visit the U.S.A. in connection with the problem. Other subjects which will be discussed include the purchase of equipment, and an average increase of 18% in tariffs, for which approval is already being sought from the Israeli Government in view of the increased operating costs. For some time now the company has been concerned at the shortage of foreign currency in Israel, coupled with severe financial restrictions in Britain, which have precluded the placing of orders for urgently needed generating plant. Fortunately, the Palestine undertaking is in a much happier position than the Jerusalem Electric and Public Service Corporation Ltd. Although the Palestine undertaking has not been able to meet the increasing demands from its 130 MW of plant (excluding the Jordan power station still in the hands of Arab forces), another 50 MW set is in course of installation and should be operating in March, while a further set of similar size should be running by the end of the year. It is also planned to commence construction this year of a new station 20 miles south of Tel Aviv. This will have an ultimate capacity of 140 MW, and it is hoped that the first two sets will be operating by the end of 1954.

Madras Scheme

Work is now progressing on the Tungabhadra hydro-electric scheme in Madras state. This will have two generating stations, one at the foot of the Tungabhadra dam near the Madras side canal take-off, and the other at the end of a 15-mile-long canal where a head of 110 ft will be available. At each of these two stations it is initially proposed to install two 9,000 kW generating sets. Orders for this plant and other power station equipment were placed a short time ago, and under the present plans the scheme should be in operation in 1956.

Mysore Outlook

In Mysore a survey has recently been concluded from which it is estimated that the power demand is likely to surpass the generating capacity of the Government's electricity system within the next two years. Obviously a serious power shortage will arise if steps are not quickly taken to provide additional power plant. Accordingly, the State Government have a number of schemes under consideration, we learn, among them the Honnemaradu hydro-electric project which would have an initial capacity of 170 MW, with the probable addition of a further 170 MW of plant at a later stage.

Set for Tasmania

The first of five 25 MW generators at Tungatinah power station of the Hydro-Electric Commission of Tasmania will probably be ready for service next July. This information has been given by the State Premier, who also stated that a reliable estimate could not yet be given as to the date of operation of the first machine at Trevallyn power station. Mr. Cosgrove also stated that since July 5 last, when Lake King William filled for the first time, the average flow of water not used for power generation had been 463 cusecs. The power which could be generated by the use of this flow of water depended on the head. If it had passed through Butler's Gorge power station the revenue obtainable would have been about £15,000. However, this revenue would have been offset by additional costs.

Waikato River Schemes

Although originally planned as one of ten hydro-electric stations to utilise in turn the waters of the Waikato River, New Zealand, it now seems that the Pararíki power station will not be constructed along with the others by the State Hydro-Electric Department. There are already three power stations, Arapuni, Karapiro and Maraetai, in operation on the river, the latter only in its initial stage, and work has started on construction of another at Whakamaru. We gather that preliminary investigations are proceeding on all the schemes planned upstream from Whakamaru, with the exception of Pararíki. This station would generate only 20 MW, and like all the other projects, its construction would involve diversion of the river, an undertaking which is now considered too costly in view of the relatively small amount of power that would be produced. Meanwhile, investigations are going ahead on works to be based on two rivers that flow into the Bay of Plenty, the Kaituna and the Rangitaiki. As planned at present, the schemes on these two rivers, together with those on the Waikato, are scheduled for completion in 1953. The omission of Pararíki will leave nine stations on the Waikato designed to have an aggregate capacity of 815 MW.

PERSONALITIES

IN THE INDUSTRY

Deputy station superintendent at Castle Meads Generating Station, South Western Division of the B.E.A., since 1949, **Mr. J. H. Parry,** Assoc. I.E.E., M.Inst.F., has been promoted to station superintendent there in succession to **Mr. D. Macleod,** A.M.I.E.E., who is leaving to take up a similar position at the Division's new East Yelland power station, as we exclusively reported in our December 4 issue. Mr. Parry commenced his career as an apprentice with the Hereford Corporation Electricity Department, and later held various appointments with the Hereford, Bury and Gloucester undertakings. In 1942 he was appointed electrical maintenance engineer after being engaged for two years in the construction and commissioning of Castle Meads generating station.

Mr. J. H. Parry

Mr. R. R. C. Rankin, O.B.E., A.M.I.E.E., A.R.T.C., a director of Mullard Equipment Ltd., has been appointed by Mullard Ltd. to be a director of Telcon Telecommunications Ltd. (owned jointly by Mullard Ltd. and the Telegraph Construction and Maintenance Co. Ltd.) in place of **Dr. C. F. Bareford,** who has resigned from the board following his appointment as chief superintendent of the Long Range Weapons Establishment at Salisbury and Woomera, South Australia, as we have already noted.

The Board of Trade announce that **Mr. W. J. Worboys,** B.Sc., D.Phil., a director of Imperial Chemical Industries Ltd., has accepted the President's invitation to become chairman of the Council of Industrial Design in succession to **Dr. R. S. Edwards,** who retires on January 31, having held the appointment for five years, and having been a member of the council since its inception in 1944. Mr. Worboys has been a member of the council since June, 1947. The present chairman of the Scottish committee of the council, **Mr. R. A. Maclean,** is to remain in office for a further two years from February 1.

Mr. A. Uretsky, P.Eng., B.A.Sc., has been appointed chief engineer of the English Electric Co. of Canada Ltd. The appointment was made by **Mr. M. B. Mallet,** general manager, who relinquishes the post of chief engineer. Mr. Uretsky joined the company in 1940, working in the engineering department, and was made manager, switchgear engineering, in 1950, which post he will retain for the time being.

Around this time of the year, many British industrialists take the opportunity to make business trips abroad. We have news of three such visits this week.

Mr. John Oldham, O.B.E., J.P., chairman and joint managing director of Oldham and Son Ltd., sailed for South Africa last Thursday, for important discussions in Johannesburg with his firm's associate company there, Oldham & Son Africa Ltd., of which he is also chairman. His itinerary includes Durban, Port Elizabeth and mining centres in Southern Rhodesia, and he will return to England at the end of March.

Mr. Arthur Croft, chairman and managing director of Crofts (Engineers) Ltd., who received a knighthood in the New Year honours list, is also on his way to South Africa to visit the company's works near Johannesburg. He will also meet the company's agents in Durban, East London, Port Elizabeth and Capetown. On Monday last, **Mr. G. W. Bone,** assistant managing director of Davey, Paxman and Co. Ltd., left by air for a five weeks tour of India, Pakistan and Ceylon.

Mr. W. A. Young, who has been in the drawing office and contracts departments of Erskine, Heap and Co. Ltd. for over 16 years, has taken charge of technical sales in Yorkshire and North Lincolnshire area for the company. Until he can obtain office accommodation in Leeds he will be working from his private address, 23 Chelwood Crescent, Roundhay, Leeds, 8. Telephone: Leeds 63417.

The Metropolitan-Vickers Electrical Co. Ltd. announces that **Mr. J. P. A. Meldrum,** O.B.E., B.Sc., M.I.E.E., has been appointed manager, home sales, in succession to the late Mr. Frank Gurney. Mr. Meldrum was educated at Rugby and Glasgow University. After a vacation apprenticeship at M.-V. in 1924, he joined the company as a college apprentice in 1926, later becoming a special switchgear trainee. In 1930 he joined the staff of the switchgear engineering department, and subsequently visited Australia, New Zealand and the U.S.A. During the war he served in the Royal Corps of Signals, attaining the rank of lieutenant-colonel, gaining the O.B.E. and being mentioned in despatches. He returned to the company in October, 1942, rejoining the Switchgear Department, of which he became sales manager in 1946. In 1951 he was appointed special assistant, sales management.

Mr. J. P. A. Meldrum

Mr. A. E. Grimsdale

Mr. J. C. Way

Following the promotion of Mr. J. P. A. Meldrum, noted above, the Metropolitan-Vickers Electrical Co. Ltd. has appointed **Mr. A. E. Grimsdale,** B.SC.(ENG.), as special assistant, sales management, and **Mr. J. C. Way,** A.M.I.E.E., A.M.I.LOCO.E., as sales manager, traction department. Mr. Grimsdale took his degree at Brighton Technical College and joined M-V as a college apprentice in 1922. After spending three years as technical engineer in the company's Sydney (Australia) office, and a further two years in the traction control department at Trafford Park, he transferred to the traction sales department in 1932. From 1941 to 1945 he was assistant to the works manager at the company's Sheffield works, being concerned with the war-time production of rotating electrical machines for service contracts. At the end of the war he became deputy sales manager, traction department, and in 1946 he was appointed manager, traction sales. Mr. Way joined M-V in 1923 as a college apprentice and after a period in the traction motor drawing office joined the traction motor engineering department at the company's Sheffield works. During the war he was engaged on special duties in connection with service contracts, following which he was appointed assistant to manager, Sheffield works. In 1947 he moved to Trafford Park, becoming a senior sales engineer in traction sales department and two years later he joined the M-V traction bureau in London. In 1951 he was appointed assistant to manager, traction sales.

Mr. Harry Eyles, secretary of the Birmingham Chamber of Commerce since 1929, is to retire in July. He will be succeeded by **Mr. W. J. Luxton,** since 1947 Legal and Parliamentary Secretary of the Association of British Chambers of Commerce. Mr. Eyles took a leading part in the inception of the engineering section of the British Industries Fair at Castle Bromwich, Birmingham.

Ekco-Ensign Electric Ltd. announce the appointment of **Mr. D. Laverick** as their representative covering part of the Manchester and Salford area.

Mr. C. A. Packer, who for more than thirty years has been responsible for the training of apprentices at the works of G. and J. Weir, Ltd., has retired. Presentations were made to him by the directors and staff, the foremen's Council and past and present apprentices.

Dr. T. E. Allibone, F.R.S., has been appointed to the board of the Edison Swan Electric Co. as director of research. He will retain his position as director of A.E.I. Research Laboratory, Aldermaston.

Elected chairman of the British Refrigeration Association for 1953 is **Mr. R. H. Hemmings,** a director of York Shipley Ltd. He succeeds **Mr. A. E. Leach,** chairman and managing director of Marco Refrigerators Ltd., who has held the office for the past three years.

Mr. Frederick W. Prime has been appointed a director of the White Electrical Instrument Co. Ltd. Mr. Prime, who has for some years held the position of technical manager, joined the company as an apprentice in 1923, and after gaining experience in all departments, undertook control of the testing and calibrating section in 1931. He was later appointed works manager, since when he has been responsible for production and development.

Chosen for the post of deputy station superintendent at Fulham generating station, London Division, B.E.A., is **Mr. M. B. Wood,** B.SC.(ENG.), A.M.I.Mech.E., A.M.I.E.E., who is at present senior assistant engineer, Co-ordination Section, Generation Operation branch of the Chief Engineer's Department of the Central Authority. From 1949 to 1951 he was deputy station superintendent at the Division's Lombard Road power station, having earlier been combustion engineer at Woolwich power station. He has also served in various capacities at Brimsdown, Kearsley and Padiham generating stations.

Mr. B. R. Fraser, B.SC., has been appointed to the post of assistant refinery manager of the Vacuum Oil Co.'s refinery now nearing completion at Coryton, Essex.

To mark the completion this month of 25 years' service with the Brown, Boveri organisation, **Mr. Henry Oswald,** M.I.E.E., managing director of British Brown-Boveri Ltd., has been presented by his staff with two prints of old London. After obtaining an engineering degree in Switzerland, Mr. Oswald came to this country in 1927 to learn the language, and subsequently joined British Brown-Boveri Ltd. as a contracts engineer. In 1932 he went to India to represent the Swiss company, and was responsible in that capacity for the equipping of the Palivasal hydro-electric power station in Travancore State. In 1937 he returned to London as general manager of the British company and has held his present position since 1947. Mr. Oswald is also chairman of the Swiss Economic Council in London, and is an active member of the City Swiss Club.

Mr. H. Oswald

Mr. E. R. Wilkinson, M.I.E.E., commercial manager to the B.E.A. is going out to Uganda towards the end of this month to advise the Uganda Electricity Board in a consultative capacity, we learn.

The E.A.W. Diploma in Electrical Housecraft with first-class endorsement in all three subjects—cookery and laundry demonstration, and salesmanship—has been awarded to **Miss P. H. Holden**, of Yeovil, and to **Mrs. K. Newman** of Taunton.

Mr. G. W. Bone, M.A., works director of Davey, Paxman and Co. Ltd., has been appointed assistant managing director of that company. Educated at Oundle and Clare College, Cambridge, he took a first in the Mechanical Science Tripos in 1939, and gained early workshop experience at Ruston's Lincoln Works. On leaving Cambridge he went to Rolls-Royce, Derby and early in 1940 obtained a commission with the R.A.F.V.R. After a period of general duties he spent some years with Air Commodore Whittle on the development of jet engines for aircraft. He joined Davey, Paxman and Co. Ltd., in July 1945 as chief experimental engineer, afterwards becoming assistant works manager, which position he held until his appointment in December 1948 as works director

Mr. F. C. Robinson has been appointed a director of A. H. Hunt (Capacitors) Ltd.

Station superintendent, Ironbridge generating station, Midlands Division, B.E.A., **Mr. P. M. Pinder,** M.I.E.E., M.I.Mech.E., is to retire at the end of March, we learn. He has been superintendent at that station since it was commissioned by the West Midlands Joint Electricity Authority in 1933.

Mr. John Burnham, cashier with the Wear subarea of the North-Eastern Electricity Board, has retired after more than 40 years in the accounts department of the Sunderland Corporation electricity department and later the Electricity Board. He has been presented with a portable radio and a nest of tables.

OBITUARY

Mr. J. Broadley, Assoc.I.E.E., second assistant (meters, test and protection) for the Yorkshire Electricity Board's No. 2 (Huddersfield) Sub-area, died on December 25, aged 49. He started with the Halifax Corporation Electricity Department, where he became meter superintendent, and in 1949 was appointed senior assistant meter engineer for No. 2 Sub-area. He was closely associated with the E.P.E.A. Northern Meter Technical Group from its formation.

Mr. James Whitcher, M.I.E.E., a consulting engineer, died on January 12, aged 83. He joined Kennedy and Donkin in 1919, and took an important part in the early design work of the British grid substations for the Central Electricity Board around 1928-1930. He retired from active day to day business with Kennedy and Donkin at the end of 1947, and for the past five years had served as a consultant to that firm.

Mr. J. W. Reid, until recently a director of Berry's Electric Ltd., died on December 15, aged 74. He began his career in 1905 with the late Mr. H. H. Berry. He was manager of the firm's Wembley works from 1928 until 1945, and served over 47 years with the company.

Mr. J. W. Reid

Mr. Harold Edward Mortimer, M.I.E.E., London sales director to the Simplex Electric Co., Ltd., from 1930 until retiring in 1947, died on January 8, aged 67. Before joining Simplex he was a director of Baxter and Caunter, Ltd., for six years, and had earlier gained experience with Edmundsons Electricity Corporation, Ltd., and the Croydon and Exeter undertakings.

Mr. W. W. Greenwood, mains engineer with the former Halifax Corporation Electricity Department from 1902 until his retirement due to ill health in 1948, died on December 27.

Mr. J. Gardner, A.M.I.E.E., who was engineer-surveyor in Glasgow to the Vulcan Boiler and General Assurance Co. for many years, died on January 11, aged 74.

Mr. R. A. Brown, who served with the Eastbourne electricity undertaking from 1896 until October, 1940, when he retired from the position of maintenance engineer, died recently, aged 78.

Mr. Robert C. Pierce, M.I.E.E., M.I.Mech.E., who died on January 10, aged 77, was engineer and manager of the Cambridge Electric Supply Co., and subsequently a director. Educated at Eton and King's College, London, he served an apprenticeship with C. A. Parsons and Co., Ltd., and afterwards served for a while with the Newcastle and District Electric Lighting Co. From 1900 to 1908 he was an assistant to the late Mr. A. A. Campbell Swinton, in his work as a consulting engineer. He became engineer and manager to the Cambridge Electric Supply Co. in 1908. Some of our older readers may also recall the prominent part played by Mr. Pierce in the successful Cambridge session of the International Illumination Congress in 1931.

Wills.—Mr. G. F. D. Campbell, chairman and managing director of Campbell and Isherwood Ltd., left estate, "so far as can at present be ascertained," valued at £29,028 gross (£28,894 net value).

Mr. J. N. Robertson, M.I.E.E., manager of the Derbyshire and Nottinghamshire sub-area of the East Midlands Electricity Board, left £5,685 gross (£5,579 net value).

Mr. M. N. Statter, formerly chief accountant of Loughborough Corporation electricity undertaking, left £689 gross (£640 net value).

Shell Moulding

An Automatic Machine for Continuous Production of Moulds for Precision Casting

IN our issue of October 23, 1952, we gave brief details of the principles of shell moulding. In this process, a moulding powder consisting of a mixture of fine sand and phenolic resin is used, in conjunction with a heated metal pattern plate. The application of the powder to the plate results in the rapid melting of the resin, and a "shell" mould of high accuracy and comparative thinness (about $\frac{1}{4}$ in.) is formed. This is then cured and can be used for direct casting.

A semi-automatic machine for carrying out the mould-forming process has now been designed by the Polygram Casting Co. Ltd., of Power Road, Gunnersbury, London. The machine has four stations at each of which the mould is processed. As the mean time for a complete cycle of the machine is 120 secs, the output is 60 complete moulds per hour.

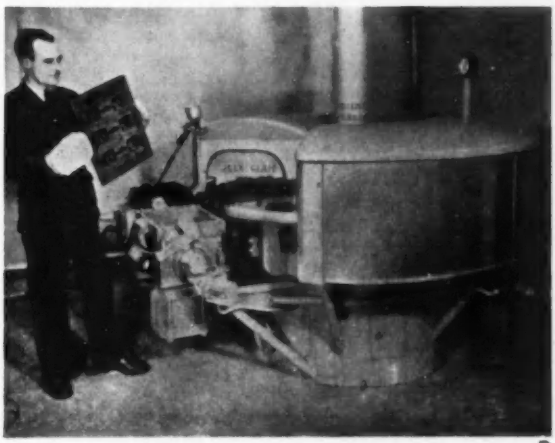
To make the mould, the plate is placed with the pattern downward on top of a "dump bin" containing the powder. The bin and plate are then inverted, allowing the powder to fall on to the heated pattern. When the shell has built up to the required thickness—in about 20 secs—the bin and plate return to their initial position and the plate and "biscuit" travel into the oven for the curing period of about $1\frac{1}{2}$ mins. An automatic ejector system lifts the biscuit off the pattern after curing, and the plate is then sprayed with stripper and the process begins once more.

The machine is driven by a 1 h.p. screen-protected motor, which is protected from mechanical overload by a safety clutch on the main shaft drive. A further safety device is incorporated to cut out the motor if the pattern plate is not returned to its carrier before indexing.

Accuracy of Casting

The general accuracy of shell castings can be taken to be within about ±0·002/0·003 in. on all dimensions not crossing the parting lines of the mould. Where the dimensions cross the parting line, the accuracy, without special precautions, falls to ±0·005/0·010 in.

In such items as the production of cast-iron cams for electrical drum controllers, the smooth wall surface of the mould is sufficiently fine and accurate to make subsequent machining unnecessary, as burnt-on sand and metal penetration into the mould are avoided.



The upper photo shows a group of castings produced by the Polygram Shell Moulding processes. The machine is illustrated on the right

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NEW LITERATURE

Mechanical World Electrical Year Book—1953

ELECTRIC lifts are the subject of the new section in this year's edition (the 46th) of this handy pocket book. This discusses succinctly the principal features of control gear operation and of maintenance procedure. There is a rewritten summary of the I.E.E. Wiring Regulations, and an addition to the information on control gear selection. As always the remainder of the book is a concise summary of information useful to the factory electrical engineer. Published by Emmott and Co., 357 pages, 6 in. by 4 in. 46th edition, price 3s.

Street Lighting

by J. M. Waldram, B.SC., F.INST.P., F.I.E.S.

THERE has been much scientific research into street lighting, but in spite of it all, the final design of any installation remains an art, albeit, one with a scientific basis. This approach is firmly adopted by Mr. Waldram in the work under review, and it gives to his writing a sympathetic quality that makes study easier. It is important in this respect, to emphasise that the volume is intended for road engineers—not for electrical or gas specialists as such. Nevertheless, there is much that the electrical engineer concerned with illumination will find relevant to his particular problems.

Quantitative aspects of the subject are discussed in the first part of the book, which deals with such matters as the appearance of the lighted street, light distribution from lanterns, and the mounting and spacing of lanterns. In part two, the acual layout of lighting installations is considered at some length for the various classes of road and for special situations. Next comes a lengthy and detailed third section covering the equipment of a street lighting installation—with assistance from another author to cover gas fittings, and then the book concludes with some general notes on economics and kindred topics, and appendices on matters considered too mathematical for the body of the work.

This is essentially a comprehensive study of road lighting. As such, it is most valuable reading for the engineer desirous of imbibing the general picture of the subject, and can be strongly recommended to him. Published by Edward Arnold and Co., 431 pages, 9 in. by 5¾ in. Price 65s.

Electric Circuits and Machines

by E. C. Lister

CHANGES to this book in its second edition are few, but of these the most important is the addition of a complete chapter on protective and switching equipment. This new addition has been made with instructive thoroughness, and despite the American techniques and equipment which are described, the section makes useful reading for the student. Other new material includes an appendix on complex quantity rotation which is treated simply in conventional methods. The book itself is designed to present to the engineering student a practical treatise on fundamental electrical circuits and machines and their present-day applications. Covering most aspects of the subject, treatment throughout is non-mathematical. Published by McGraw-Hill, 427 pages, size 9 in. by 6 in. Second edition, price 32s.

Hydraulics

by E. H. Lewitt, B.SC., PH.D., A.M.I.MECH.E.

DEMAND for this excellent degree standard textbook has been constant ever since it first appeared in 1923, and the present edition is the ninth which Dr. Lewitt has been called upon to prepare. The principal addition to be noted this time is a chapter dealing with the very complex problem of gas flow through pipes. As an adjunct to this chapter, Dr. Lewitt has prepared a chart from which results for the adiabatic flow of air can be read off direct. Apart from this addition, the pattern of this well-tried book is maintained. Published by Pitman, 662 pages, 8½ in. by 5½ in. Ninth edition, price 25s.

BOOKS RECEIVED

The Lubrication of Oil Engines, a concise survey of modern practice with notes on causes and remedies of operating difficulties and on lubricating oil selection. Published by Shell-Mex and B.P. Ltd., Shell-Mex House, Strand, W.C.2, 160 pages, 9½ in. by 6½ in. Gratis.

Practical Electrical Wiring, by H. P. Richter. Detailed textbook based on 1951 American National Electrical Code. Published by McGraw-Hill, 602 pages, 8 in. by 5½ in. Fourth edition, price 55s. 6d.

Redgraves Factories, Truck and Shop Acts, by J. Thompson and H. R. Rogers. Legal reference book extensively annotated. Published by Butterworth and Co. (Publishers) Ltd., 1,418 pages, 6¾ in. by 4½ in. Eighteenth edition, price 50s.

Controllers for Electric Motors, by H. D. James and L. E. Markle. Detailed notes on American equipment for installation and design engineers. Published by McGraw-Hill, 426 pages, 9 in. by 6 in. Second edition, price 59s. 6d.

The Electrical Fundamentals of Communication, by A. L. Albert. Textbook on electrical technology for communications students. Published by McGraw-Hill, 531 pages, 9 in. by 6 in. Second edition, price 59s. 6d.

Direct Current Machinery, by C. S. Siskind. Undergraduate standard textbook. Published by McGraw-Hill, 319 pages, 9 in. by 6 in. Price 51s.

Electrical Units, by E. Bradshaw. Notes for students with special reference to the M.K.S. system. Published by Chapman and Hall, 64 pages, 8½ in. by 5½ in. Price 9s. 6d.

The BUYER'S *Column*

Pye Re-enter Appliance Market

FOLLOWING on the lifting of restrictions on appliance manufacture, yet another leading company, PYE LTD., of Cambridge, has entered the domestic appliance market for the first time since the war.

In a letter to their agents, the company say that although for some time they had realised that the name of Pye would help establish them quickly in this sphere, they waited until they found a proven product in which they had every confidence.

Pye re-enter the market with the "Polly" tea-maker

The first appliance marketed since the war is the Pye "Polly"—an automatic tea and coffee maker which has already met with nation-wide success, marketed under the name "Tiffee" by L. G. Hawkins and Co., Ltd., of Drury Lane, London, an associated company of Pye Ltd. (see ELECTRICAL TIMES, October 3 issue, p. 602).

This tea and coffee maker boils water, pours it into a teapot, cuts off the current and then sounds a buzzer. It has a safety cutout which prevents it being switched on without being filled with water and it cannot boil dry.

Now available only in a mist-blue finish yet guaranteed for 12 months by Pye Ltd., the appliance retails as before at 75s., no purchase tax. This standard model is for 200/250 V a.c. mains, whilst a d.c. model is available.

This new product is being backed by an intensive selling drive and large-scale advertising.

At present no other lines have been announced, but it is believed that further appliances will be marketed after an interval of a few months. Meanwhile the company intends to sell the "Polly" in large quantities overseas.

Gasket for Striplight Holders

A RUBBER gasket has been put on the market by METWAY ELECTRICAL INDUSTRIES, LTD., 21 King Street, Brighton 1, which is intended to make the ordinary striplight holder watertight.

This slips over the junction between the lamp cap and the socket of the lampholder and will be found useful in the making of the economical watertight temporary installations for Coronation lighting., etc.

The model will be known as the CF.666. Prices are minimum quantities of a gross, 36s. per gross with discounts for greater quantities.

No Quotas for "Swan" Kettles

THE allocation scheme whereby "Swan brand" electric kettles have been distributed on a quota basis has now been discontinued say the makers, BULPITT AND SONS LTD., Swansea Works, Birmingham 1.

All orders on the firm's files will be executed as quickly as possible. The company asks that orders are placed well ahead in view of the imminent re-introduction of their polished and lacquered copper kettles and the re-introduction of their chromium plated kettles as soon as the present restriction on the use of nickel is removed. If the restriction is not soon removed the firm intends to introduce an alternative finish. A recent leaflet gives details of price revisions on all electrical appliances as from January 12.

Hotpoint Percolator Returns

THE removal of the restrictions of the use of raw materials has enabled THE HOTPOINT ELECTRIC APPLIANCE CO., LTD., Fletton, Peterborough, to re-introduce the Hotpoint Percolator, Cat. No. 614 P.1.

This model has its body and central tube of heavy gauge copper finished in chromium plate with the interior heavily lined. It is fitted with a safety replaceable plug which protects the percolator from damage if switched on empty or allowed to boil dry. For normal voltage ranges the price is £5 10s. no purchase tax.

Price Changes

The Hotpoint Bowlfire has been reduced in price to £2, plus £1 9s. 5d. purchase tax, as against £2 10s. plus £1 16s. 9d. Prompt delivery of this fire can be given.

Another reduction announced by the company concerns their Torribar immersion heaters and water circulators, as from December 31, last. Full details of these reductions which are quite substantial are given in price list HEA.400-6002, now available.

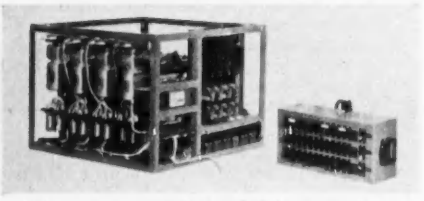
As from January 1, an increase of 10% in the price of all products of Tricity Cookers Ltd., 109 Kingsway, W.C.2, is announced. There has, we understand, been no increase in prices since 1947.

A New Remote Control Dimmer

WITH mounting interest in Coronation lighting the release of a new remote control dimmer bank is a timely reminder that fluorescent colour floodlighting will play an effective part in many outdoor illumination schemes this year.

This dimmer, the Atlas 4/RC/6/M, introduced by THORN ELECTRICAL INDUSTRIES LTD., 105 Judd Street, London W.C.1, comprises a four-colour motorised dimmer to control six 5-ft. 80 W four-tube fluorescent floodlights with a remote master control panel. The units are of the 100 step radial lever type driven by double reduction geared motors giving three complete dimming cycles per minute. Mounted within an enclosed weather-proof iron framework, which also houses chokes, relays and fuses, each dimmer is completely self-contained and can be replaced by one of a different rating, if required, in a few minutes.

The compact control panel communicates with the dimmer unit by a single multi-core telecommunication cable. The bottom row of telephone type switches puts each group into a "raise," "hold" or "lower" position; the middle row provides "black-out," "dimmer" and "master black-out" facilities while the upper row provides "short circuit," "dimmer" and "master short circuit" positions for instantaneous full lighting irrespective of the setting of the individual dimmers. Master switches at the end of each row give simultaneous operational control. If required, an auxiliary feature can be supplied to give an automatic colour changing sequence. Control panels are designed to control one, two or more motorised units, the one illustrated being for three units.



This remote control dimmer bank comprises a four-colour motorised dimmer with a master control panel

Hopper Contents Control

STORAGE hoppers are vital parts of many processing plants, being employed for such purposes as the storage of raw, partly processed, or completely processed materials, or as reservoirs to ensure that subsequent processes or machines are not starved in the event of a temporary hold-up during earlier stages of production. The latter application is of vital importance when processes are operated automatically and continuously, and thus it has become essential to control automatically the amount of material in the hopper.

An example of such a process is provided by the large-scale production of a well-known powered chemical compound. The earlier stages of manufacture are concerned with abstracting certain solids and grinding and mixing them to produce the finished material, which is discharged into two hoppers in the packing dept., one being 8 ft deep and of 5 tons capacity, and the other considerably smaller. The first acts as a bulk storage hopper, and the second feeds an automatic weighing and packing machine.

The process is both continuous and automatic, and thus some means of controlling the amount of material in the hoppers is essential. This has been done in a simple and foolproof manner by using the type B.L. 49 bunker level control developed by RADIOVISOR PARENT, LTD., 1 Stanhope St., London N.W.1. This foolproof unit operates from the electrical conductivity of the material, and is quickly and easily installed. It incorporates a projecting rod-type electrode of any length to suit the requirements of the installation, which is electrically connected to a small control unit comprising a single-stage thermionic valve amplifier incorporating red and green lights, and terminals for connection to an external audible alarm. Because "full" and "empty" conditions have to be indicated it was necessary to employ two electrodes, one at the top and the other near the bottom.

TRADE PUBLICATIONS

CABLES.—New publication No. 318, issued by British Insulated Callender's Cables Ltd., Norfolk House, Norfolk Street, W.C.1, deals with the construction and applications of the company's "Bestos" A.V.C. (asbestos-varnish cambric) cables.

TRANSFORMERS.—Just to remind engineers of the production of their company, Foster Transformers Ltd., South Wimbledon, London, S.W.19, have issued an illustrated brochure which shows their "Principal Products."

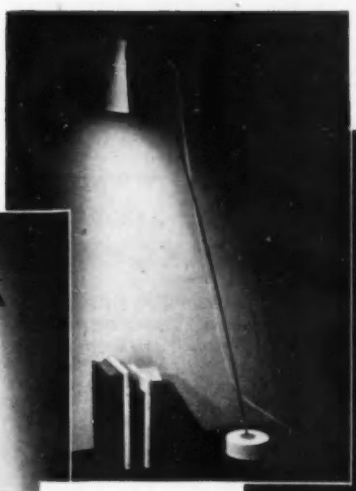
WIRES AND CABLES.—British Insulated Callender's Cables Ltd., Norfolk House, Norfolk Street, W.C.2, have now published a new booklet on their "Bicalex" winding wires.

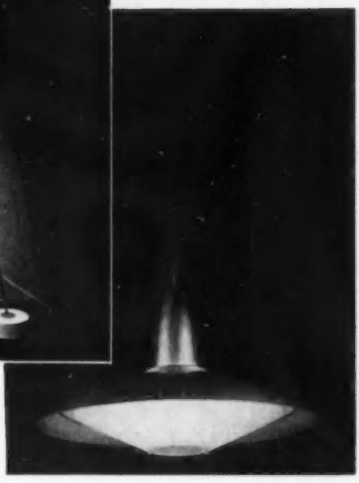
LIGHTING FITTINGS.—An attractive catalogue featuring decorative lighting fittings has been issued by Falk Stadelman and Co. Ltd., 91 Farringdon Road, E.C.1.

LOUDSPEAKERS.—Stantel cabinet loudspeakers employ the principle of sound radiation through a narrow aperture to ensure quality of reproduction and even distribution. These speakers are described in a specification sheet issued by Standard Telephones and Cables Ltd., Connaught House, Aldwych, W.C.2.

REFRIGERATION.—Available on request from the Sales Promotion Department of the Pressed Steel Co. Ltd., Cowley, Oxford, is a catalogue sheet Z130, dealing with Lollipop Freezers.

New Look 1953





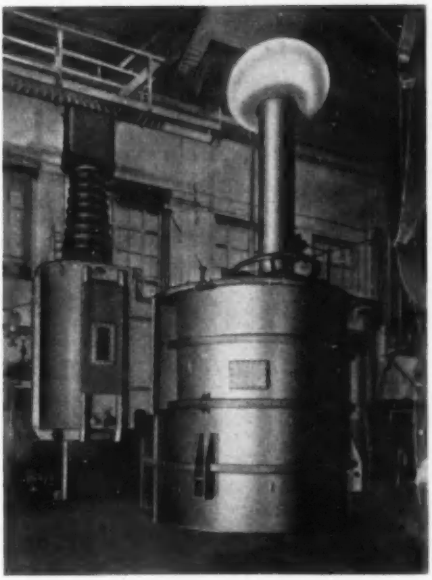
These new contemporary fittings introduced by Geo. Forrest & Sons Ltd. achieve great variety using only a few basic components

Table lamps, wall brackets and floor standards comprise anodised duraluminium rods, lever-handled clips and aluminium spinnings in three shapes and various colours. Pendants use glass, Perspex and buckram to good effect. The company is a subsidiary of Thorn Electrical Industries Ltd.

Testing 275 kV Transformers

A PROTOTYPE of the eight 120 MVA, 132/275 kV, 3-phase auto-transformers ordered by the B.E.A. from Metropolitan-Vickers Electrical Co., Ltd., was recently tested in the Trafford Park works. This prototype consisted of a full-scale leg of windings, complete with tappings, mounted on the centre leg of a special three-legged testing core, and connected to a type "H" single-phase 18-step tap-changer with resistance transition. The general arrangement is shown in the photograph. The impulse withstand level was demonstrated by the following shots. At the 132 kV terminal, one 550 kV crest (full wave); two 640 kV crest (chopped waves); and two 550 kV crest (full waves). At the 275 kV terminal, the tests included one at 1,050 kV crest (full wave); two 1,200 kV crest (chopped waves); and two 1,050 kV crest (full wave).

For the eight 120 MVA transformers to be supplied by Metropolitan-Vickers Electrical Co., 24 type "H" tap-changers are required, and in addition a further 45 orders are in hand.



Prototype under test in the works

The WEEK in NEWS

National Assistance for Exporters

Minister of Supply offers Hope to Small Firms

AN offer of Government aid, especially to small firms, has been made by the Minister of Supply, in an endeavour to step up this country's rate of exports. At the close of his tour of the Midlands Mr. Sandys urged small manufacturers to explore the possibilities of direct export. As an encouragement, he promised them all possible assistance from the Government to help them achieve that important contribution to Britain's engineering exports. The actual form which that help will take, is not yet known, but a small indication was given in the Minister's remarks.

Mr. Sandys said Government was exploring the possibilities of assistance in the way of credit terms. A number of useful ideas on the subject had already emerged, he said, from discussions his department had had with industrialists. It will be recalled that about seven weeks ago, Sir Roland Matthews of Brush Electrical Engineering Co., Ltd., appealed for just such help (see our November 27 issue). It was stated at the time, however, that the Government was against financing that method of trading, except on the limited scale carried on by the Export Credit Guarantees Department. This appears to indicate a change in attitude.

In addition, the Ministry of Supply is taking the initiative by convening a small study group of industrialists from the Midlands. This is to consist of both large and small firms who will try and assist each other in breaking into export markets.

Govt. Contract for Hearing-Aid Batteries

ONCE again the entire order for batteries used under the National Health Service for hearing aids has been placed with Vidor. The contract representing requirements until June 1954, amounts to about two-million l.t. 1½ V and 250,000 h.t. 30 V batteries. This is the second year that this large Government contract has been given to the company. Last January some 3,324,000 "Medresco" batteries were ordered and a further order for 120,000 batteries was placed in November.

German Plans for Atom Plant

GERMANY is planning the construction of a huge cosmotron, calculated to have about 15 times the power of the largest American atom smasher. Headed by Dr. Werner Heisenberg, the country's foremost nuclear physicist, German atomic scientists are working out a vast nuclear research programme. They are endeavouring to form a European Atomic Research Institute to finance the project, estimating that it will cost about £4 million.

ELECTRICITY PRICES LIKELY TO RISE IN SOUTH-EAST

PROPOSALS for an increase in the price of electricity in the S.E. Electricity Board's area have been considered at a private special meeting of the Consultative Council. There is no information available at present of the content of the proposals or of the outcome of the recent meeting, but it is understood that domestic, commercial and industrial tariffs will be affected. Opinions of the Consultative Council are being submitted to the Board for consideration before any decision is taken. Higher coal prices and transport charges are said to be the cause of these new proposals, which are not expected to become effective for some months. Charges in the area were increased last April.

Coal in Europe

THE first year's report of the High Authority which deals with the production of coal and steel in Western Europe was issued last weekend. It shows that during 1952, member countries produced 240 million tons of coal, 18 million tons of iron ore and 42 million tons of steel. Consultations are taking place on the present situation and immediate prospects, long term prospects, and programme of expansion.

The First Half-Century

It is reported that an effort is being seriously made in Sweden to make use of the stimulating effect on plants, and especially on germination, that has long been known to belong to weak continuous currents applied in a certain way. A seed field is covered by a network of wire, through which a current is passed during nights and chilly days, but cut off during warm and sunny weather.—*From our issue of January 15, 1903.*

BRITISH TEAM TO STUDY AMERICAN ENGINEERING

THE first team to visit America under the auspices of the British Productivity Council sails from Southampton today. During the era of the former Anglo-American Council, some 65 parties crossed the Atlantic to report on details of many industries and techniques but the present team is travelling with the sole object of discovering how new knowledge and new ideas are applied. Its task will be to investigate the source of America's apparent alertness to improve methods of manufacture.

The team is being led by Mr. W. F. Garnham, of Ransomes, Sims and Jefferies, Ltd. Included among the other 13 members of the party are Messrs. N. A. Hare, of Joseph Lucas (Electrical), Ltd., H. Rothwell of Brookhirst Switchgear, Ltd., and J. H. Cribb of B.T.H.

Newcastle Contract placed with Lancs Firm

LOCAL E.C.A. PROTEST TO CITY COUNCIL

EARLY last month the Newcastle branch of E.C.A. was in the news regarding the allocation of contracts in the Sunderland area. We hear now that this same branch is active in Newcastle itself on another matter. It has protested recently against the possible placing of a £20,184 contract with a Lancashire firm for work in the city involving the conversion from gas to electricity in some 930 houses.

It is contended that local contractors have the staff to carry out the work on a given number of houses, and the contract should be broken up into smaller contracts for the purpose. Sunderland has been cited as an example of such a scheme which is operating satisfactorily. A letter to this effect was sent to the City Council, who decided to receive it. Clr. Henderson reported to the committee that 12 Tyneside firms had tendered but the Colne (Lancashire) contractors offered the lowest quotation. He added that his committee had been concerned at condition of work being carried out by local firms and had not been satisfied. The second lowest tender submitted was stated to be £22,993.

A Conference on Engineering Education

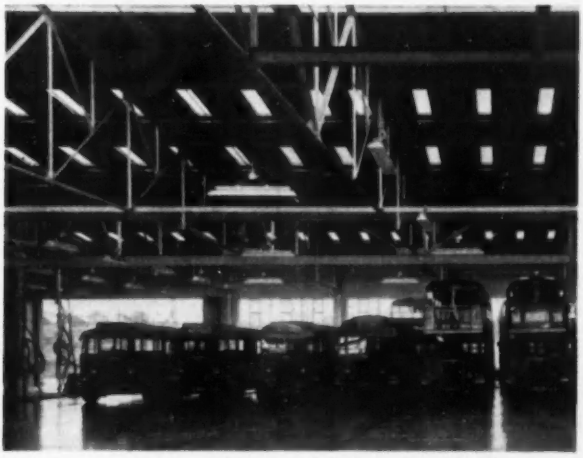
A CONFERENCE of engineering education was held at the Institutions of Civil, Mechanical and Electrical Engineers, during the early part of this week. Representatives of ten European countries as well as from Britain and the U.S. attended. Its object was to further a better understanding between the participating nations of the methods each is adopting for the education and training of professional engineers. Some two years ago it was decided to hold such a conference—the decision being taken at the last meeting of F.U.S.E.C. at the Hague. After the working sessions, delegates will visit engineering laboratories and technical colleges.

Catenary Wiring for Garage Lighting

NORBITON GARAGE, recently completed as part of London Transport's extensive post-war garage programme, makes successful use of the Enfield grid suspension wiring system for lighting the major part of the working area. In the wide spans necessary for the accommodation and manoeuvring of large vehicles, full use can be made of the flexibility of the system.

The parking area, which is shown in the illustration, is laid out to a predetermined plan for the accommodation of vehicles on which servicing is carried out during their standing period. It is this scheme which the lighting installation is designed to serve. Enfield grid suspension 3/·036 in. twin cable and connection boxes are arranged so that, when the garage is full, maximum illumination from the 112 Strong Electric fluorescent fittings is provided in the fore and aft gangways between the vehicles. Sufficient light then spills into the secondary lanes.

The entire grid suspension installation was carried out by London Transport's Plant Engineer, Mr. T. C. Ball, in conjunction with Messrs. J. H. Coombs and Partners, consulting electrical engineers.



Grid suspension wiring system used in lighting system for large area at the recently completed Norbiton bus garage

Reply to Air Pollution Allegations

THE Minister of Fuel and Power has answered complaints about atmospheric pollution in Stoke-on-Trent. He promised to investigate whether the nationalised industries were making a real contribution towards greater smoke abatement at a dinner of the Staffordshire Chamber of Commerce last November.

As far as the electrical industry was concerned, Mr. Lloyd stated that the large boilers used should never emit black smoke if properly managed. They were also designed with grit eliminators which had proved efficient, with the result that coal burnt by the B.E.A. polluted the air less than most factories, and much less than the domestic grate.

The Minister added that unfortunately it was still necessary to keep old plant running, and among the older boilers in commission were some at the Stoke power station. These had mechanical grit arrestors and should not produce dirty smoke normally, but had done so recently due to technical faults. These had been rectified. The only effective remedy was the displacement of old plant, and this was being done as quickly as possible. Modern power stations were being built faster than the load was rising and old plant being used less and less.

MEASUREMENTS AT THE N.P.L.

METHODS of test used at the National Physical Laboratory to determine the properties of insulating materials, are described in a booklet newly published last week, No. 3 in the Laboratory's "Notes on Applied Science Services," it adds to this description of N.P.L. methods a succinct discussion of the salient properties which class a material as an insulator.

Electrical tests which are described include those for strength, flashover, resistivity, permittivity, power factor, and tracking. In all cases there is a discussion of the apparatus used and the techniques involved. Mechanical tests are also dealt with; and there is consideration of the dependence of electrical properties on physical conditions.

Apart from other notes of a miscellaneous nature, this interesting publication includes a table of the properties of leading insulating materials, and a useful selection of references to sources of fuller information. It is published for the D.S.I.R. by H. M. Stationery Office, price 1s. 3d.

IRONFOUNDERS RESIGN

THE Colchester firm of Davey, Paxman and Co. Ltd., together with its associate, Ruston and Hornsby Ltd., of Lincoln, has resigned from membership of the Iron Founders' National Confederation. This was announced last week, and is in protest against the policy of the Council of Ironfoundry Associations over the Iron and Steel Bill. The Council has reproached sponsors of a ballot to ascertain whether the industry was in favour of supervision under the Bill. Davey, Paxman and Co. state they will continue to oppose control of ironfounding proposed in the Bill, despite their resignation from the Confederation.

OFFICIAL PUBLICATIONS

APPLIED SCIENCE No. 3. Properties of Electrical Insulating Materials and Methods of Test. Issued by N.P.L. H.M.S.O. 1s. 3d. (*See this page.*)

BRITISH STANDARDS

B.S. 740: Pt. 2: 1952. Portable Fire Extinguishers of Foam Type (Gas Pressure).

B.S. 1917: 1952. Film Strip and Lantern Slides.

P.D. 1523: 1951. Safety Requirements for Electric Fires—amendments to B.S. 1670.

P.D. 1519: 1949. Eighty-ton, 2½% Nickel-Chromium-Molybdenum Steel (High Carbon)—amendment to S.99.

B.S. 116: 1952. G.7 Circuit-breakers for a.c. Systems.

CURRENT RATINGS FOR 33 kV SOLID TYPE CABLES. Published by Cable Makers' Assoc.

INDIA ALLOWS MORE IMPORTS

THE Indian Government has recently given permission for the import of certain commodities from (among other countries) Great Britain. The new regulations apply, in fact, to all except the dollar countries and South Africa. They are subject to certain conditions which are merely formalities. Among the items listed are electrical generators (with provisos), switchgear, switchboard and indicating and recording instruments, portable electric tools, paper insulated cables, carbon electrodes and electro-medical apparatus.

M.E.B.'s Showroom for Industrialists

WITH the huge concentration of industry in the Midlands the area's electricity board has taken a notable step in assisting the national productivity campaign. Nearly every town in the country now has an electricity showroom, but these are almost exclusively catering for the domestic consumer. Not long ago the M.E.B. opened an industrial showroom at 247 Chester St., Aston, Birmingham, and to date, this has proved a most successful venture.

Two exhibitions have been staged at the premises so far. One dealt with "Power Factor Correction" and the second with "Stud Welding." At both the attendance topped the hundred, indicating that between 50 and 80 firms were represented. We note that a third exhibition on "Industrial and Commercial Communication Systems" opens tomorrow. Among the equipment on view will be inter-office communication equipment, sound amplifying and tape recording equipment, and other similar apparatus. The arrangements take the form of a private exhibition and intending visitors are asked to communicate with the showroom (Tel. Aston Cross 1502) beforehand. The display will remain open until January 30 and there will be two open periods daily.

TV FIRMS MUST REPAIR ANY DAMAGE

ONLY those retailers in Stourbridge who sign an undertaking to make good any damage done to houses will be allowed to fit television sets to council houses. The council's decision to seek such an undertaking followed a lot of damage caused by workmen. The step was taken to protect property. So far eight of the 13 firms in the area have signed, four have not replied to the letter and the fifth, the Midlands Electricity Board, has refused. The Board does not consider the undertaking to be a reasonable one in its present form.

Cable for Turkey

A LARGE consignment of mains cables has just been supplied by the Edison Swan Electric Co. to the Turkish paper-making firm of Sumerbank Cellulose Industry Establishment at Izmit. Over 60 kilometres was shipped to the works, where a second scheme of expansion is now nearing completion. The cables used throughout the recent additions to the factory are paper insulated, lead alloy sheathed and armoured, and were used mainly as H.T. feeders and substation connections carrying power to 20 switchboards feeding nearly 500 motors and 54 motor-generator sets.

Winners of the Eccles Shield in a recent window display competition run by the Merseyside and N. Wales Electricity Board, were Northwich service centre, whose display is shown here. A three-colour variable lighting effect was used, and fluor-painted price tags illuminated by ultra-violet lamps. The "ruby" in Ali Baba's turban came from a cooker control panel

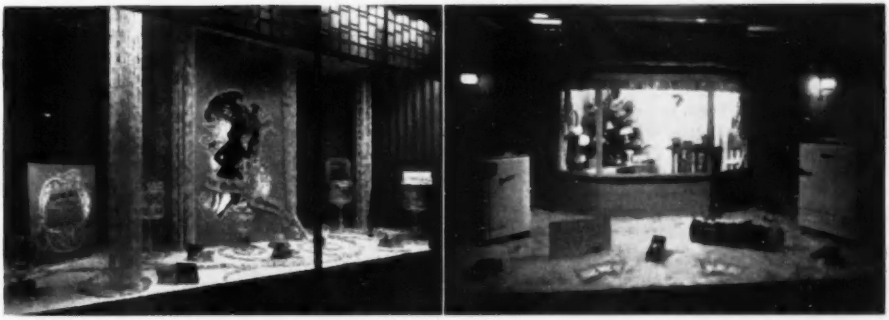
Joint Winners of N.W. Display Contest

FOLLOWING the announcement last week of the results of the Eastern Electricity Board's Christmas display competition, we have now received results of a similar contest which took place in the North Western Board's area. This, incidentally, was the fifth such competition to be staged by the Board, and for the first time there was a tie for first place. Joint winners were the Wigan and Ashton-under-Lyne showrooms, who will each hold the trophy for six months.

There was a total entry of 82, of which seven—one from each sub-area—reached the final. Apart from the winners, the Carlisle display was specially commended. Theme of the 1952 competition was Christmas and New Year Gifts, and a good idea of the standard achieved may be gained from our accompanying illustrations.

B.E.A. Finds Old Coin

SOME time ago a silver coin was sucked up from the river bed by a pump at Uskmouth power station. The coin has been identified as a tetradachm of about 162 to 150 B.C. of the time of the Syrian King Demetris I. A portrait of the king is on one side of the coin, while on the other is an image of Tyche, Greek goddess of fortune.



Winning windows in the N. Western Board's annual Christmas display competition. The Wigan window (right) shows the exterior of a house giving the shopper a peep through the window to a room and Christmas tree full of electrical gifts. The Ashton display (left) has a background silhouette of a lady drinking a toast—large tinsel wine glasses each suggest a suitable gift

Modern Fittings in New Showroom

A NEW showroom opened a short time ago by the Cardiff branch of the General Electric Co. has been designed and laid out to give an admirable display of contemporary lighting fittings. Little can be added in words which would give a better impression of the room than our accompanying illustration, but the picture hides many difficulties which faced the designers who undertook the scheme. In the first place the showroom is a basement, and secondly the shape of the room is a clipped square. To counter these problems and extend the field of vision, an enlarged photograph was mounted in a frame on one wall to give the illusion of a beautiful view through a large window. Colours in the room were carefully chosen to soften the concentration of a large quantity of light. It will also be seen that two floor levels have been included and the opportunity has been taken to carpet the lower level in green while the upper part has been composed of polished wood.

The application of modern lighting fittings to furniture of contemporary style is admirably depicted at this new G.E.C. showroom opened in Cardiff

B.E.A.C.'s NEW TELEPRINTERS

ON Monday afternoon a new teleprinter station for the British European Airways Corporation was officially opened by Lord Douglas of Kirtleside, Chairman of the Corporation, who transmitted the station's first message to M. Monniot, President of S.I.T.A., the International Co-operative Organisation for Aeronautical Telecommunication. One of the largest in the country, the new station comprises apparatus for receiving and transmitting over 24 channels, between Paris, Dublin and Manchester. Later it is hoped connections will be made with New York and Glasgow.

The new apparatus is solely the property of the B.E.A.C. who collaborated with Messrs. Hallam, Sleigh and Cheston, and Messrs. Creed and Co. The station is capable of handling 12,000,000 words/month.

NEWS IN BRIEF

Wallasey's first Technical Institute is to be officially opened next March.

A Conference for Small Firms on "Making the Most of Limited Resources" is being arranged by the British Institute of Management. It will take place at Ashorne Hill, near Leamington Spa, between February 13 and 15.

In our article dealing with the Fraser and Chalmers chalk crushing plant installed for the Chinnor Cement and Lime Co., we gave the output as 75 tons/day. We have been asked to point out that the actual capacity is 75 tons per hour.

The dates of the Summer School on Welding were incorrectly given last week as April 27 to May 22. The B.W.R.A. has since amended its announcement—the course having been arranged to end on May 2.

The B.B.C. is to build a low-power transmitting station at Mousewold, near Dumfries, to improve radio reception in the area. Meanwhile, a temporary transmitter will be installed on the site.

Selling prices of tungsten ores of standard 65% grade and ordinary quality have been reduced as follows: Wolframite to 392s. 6d. and Scheelite to 382s. 6d. per long ton unit delivered consumers' works.

Dorman and Smith, Ltd., have arranged another three demonstrations of their miniature circuit-breaker. They are to take place at St. Ermin's Hotel, London, on February 3 and 4.

In the article "Mercury Cells," which appeared in our issue of December 18, an error was inadvertently included in the curves on page 1103. The current drain for a resistance of 20 ohms is 63 milliamperes, and not 83 as was stated.

Recent Annual Dinners

THIS is the season of annual social events among firms and other organisations. Recent functions of this kind include the annual dinner of the A.S.E.E.'s W. London branch. Principal guest was the Association's president, Mr. C. T. Melling. The dinner was followed by dancing. Some 320 members gathered for the eighth annual dinner and dance of Johnson and Phillips' Staff Association. A third notable social event was the Christmas dinner of Courtney, Pope (Electrical) Ltd. Over 400 employees and their wives attended.

Electric Supply News . . .

Armagh

The Electricity Board for Northern Ireland has applied to the Ministry of Commerce for permission to erect certain o.h. lines in Armagh, the Urban District Council has been informed. Apparently the Council had stipulated that power lines across the corner of the swimming baths should have safety cradles underneath. The Board maintained this would mean that there would have to be cradles under all lines in thickly populated districts, and that could not be done. After discussion the Council agreed that the responsibility for permitting unprotected wires to be erected must rest with the Ministry—the Council would not accept it.

Cardiganshire

A £14,000 electricity scheme for the parishes of Blaenporth, Tremain and Verwig in the Teifiside district of Cardiganshire, was switched on by Capt. Roderick Bowen, Q.C., M.P., recently. This rural scheme which supplies 50 consumers, including 33 farms, is the largest completed in the counties of Cardigan, Carmarthen and Pembroke since vesting day.

Dartmouth

The Council last week agreed to refer back to the Works and Highways Committee a recommendation that £860 should be paid to the South Western Electricity Board for the alteration of cables and the removal of equipment to allow the Townstal substation site to be moved back 20 ft to conform to the housing estate's present building line. The reference back was moved by Mr. W. T. Pillar, who thought the cost of £860 was absurd. The Clerk told the Council that the Electricity Board had stressed that the moving of the site was a matter of some urgency affecting the supply of power to Dartmouth. If there was any delay the cost might ultimately be much higher.

Derry

Can farmers in the Derry rural area adjoining the border obtain a supply of electricity from either the Electricity Board for Northern Ireland or the Eire Electricity Board? According to one member of the Rural District Council, one farmer there is getting a supply from across the border and he believes others will do the same if the N. Ireland Board delays unduly in supplying them. This statement was made at the recent meeting of the Council when discussion centred on a letter from the Board concerning rural electrification on the west side of the Foyle. The Board wrote that it had been proceeding with the electrification of rural areas to the full measure of the money and materials available and as soon as commitments permitted it would consider the possibility of development west of the River Foyle. The chairman of the Council, Mr. J. Hatrick, said he was glad to know that the Board was doing something for the west side of the river. They were of the opinion that they would get electricity from the Republic sooner. The Council decided to ask the Board for the approximate date it would be starting work west of Foyle and also to tell the Board that, if there was undue delay, farmers would consider getting electricity from the other side of the border.

Dumfries

After discussion on whether houses at a new estate should have gas installed or be all-electric, the town council decided by 14 votes to 8 in favour of all-electric. It was said that the South West Scotland Electricity Board had offered to install electricity in new houses at £3 per house if they were all-electric, but £15 per house if gas was also installed. One member described the offer as holding the council to ransom, and stated that in other parts of Scotland concessions had been made. The treasurer, Mr. G. B. Harkness, said the Council would save £4,000 by having all-electric houses.

Larne

An appeal by the Electricity Board for Northern Ireland against the decision of the Larne Borough Council refusing permission to carry out electricity development in the borough, was heard last Friday. It was stated that in September last, the Council, in giving the Board permission to augment its overhead l.v. distribution system in the area, imposed 43 conditions, which meant that the overhead crossings, being considered unsightly, should be placed underground. To carry out those conditions would involve an expenditure of £6,231. Under the proposed scheme, o.h. l.t. lines crossing the streets of Larne would be reduced from 232 to 131. For the Borough Council it was suggested that the Board's scheme was not a replacement but reconstruction. The Council agreed to pass the plans subject to the modest conditions. They said that o-h. crossings detracted from the general amenity of the town, and consented to the scheme as a whole on condition that the Board would make underground crossings on the main thoroughfares and particularly on the roads leading to the coast. Mr. C. Ross, M.B.E., Mayor of Larne, suggested that the increased cost involved should fall on the consumers generally, and in this he was supported by Mr. H. M'Kay, chairman of the Improvement, Streets and Roads Committee. Mr. J. Steel, an inspector of the Ministry of Health and Local Government, who conducted the enquiry, said a decision would be given later.

Lichfield

An enquiry was held at Lichfield last Thursday into the B.E.A.'s proposal to erect 132 kV o.h. cables across land at Elford as part of a line to carry additional power to the Smethwick area from Drakelow power station. On behalf of the B.E.A., Mr. B. H. Bliss said the line had become

essential as there was a deficit of about 200 MW in the area and it was likely to increase. The route had been approved by all the relevant local authorities and Government departments concerned. The line would cross land owned by 94 different persons, of whom 88 had given their consent. At the enquiry, the main objector was Mr. E. F. Wain, of Elford Park Farm. His grounds for objecting were fourfold: that the proposed route was not the most direct one; that the line would take away the privacy of his house; that it would seriously depreciate the value of his farm; and that B.E.A. employees could at all times enter his land to inspect the lines and cause damage and inconvenience in regard to arable land. The enquiry was conducted by Mr. H. W. Grimmitt, who later visited the site.

LIGHTING SCHEMES

Eastbourne.—The Highways Committee is seeking Ministerial approval to a scheme for improved lighting in Langney Rise and Friday Street.

Hampstead.—B.C. is recommended to approve the installation of improved lighting in Finchley and Fortune Green Roads at a cost of £3,575.

Prescot.—The U.D.C. has received the approval of the M.o.T. to the scheme to install more than 80 140W sodium lamps on the trunk road through the town, at a cost of £3,633.

Salford.—T.C. being asked to approve a proposal of the Street Lighting Committee to borrow £23,550 for improving street lighting in Higher Broughton, on Road A6, and at various flats schemes.

Scunthorpe.—T.C. has adopted a 3-year programme for improving lighting in the principal streets at a cost of £37,000.

Sunningdale.—The M.o.T. has turned down the Parish Council's plan for new street lighting, but has suggested it may be considered in the future.

Warrington.—Application is being made for consent to borrow £9,360 for new lighting in certain areas in the town.

Company Activities . . .

British Industrial Plastics Ltd.

Already forewarned of the difficulties encountered by this company during its year ended September 30 last, the shareholders will not be surprised to learn of the reduction of over £200,000 in the trading profit for that period. The preliminary statement just issued shows that the trading profit for the year is £352,812, and there is to be a dividend of 12½%, compared with 20% for the previous year when a bonus of ½d. per share tax free was also paid out of capital profits. The net profit amounts to £33,489 (*£159,957*). In an interim report issued last November the company stated that orders for exports had increased from many sources, although the Australian market still remained substantially closed.

General Cable Manufacturing Co.

The profit for 1952 was a slight improvement on the previous year's total, it will be seen from the accompanying table, rather as indicated in May last at the time of the offer of 100,000 Ordinary shares at 10s. each. These additional

Year to Sept.30	£ Trading Profit	£ Net Profit	% on Ord. Earn'd	% on Ord. Paid	Ord. Price High	Ord. Price Low
1948	—	46,124	106	40	51/3	36/-
1949	—	38,048	52	38•	21/11	16/6
1950	—	40,979	56	30	17/9	14/3
1951	120,473	46,715	67	30	18/9	16/6
1952	146,077	47,766	70	30†	16/10	11/10

•Capital bonus of 66⅔%.
†Final of 18% on larger capital.

shares participate in the final dividend of 18%. There is again a sum of £20,000 transferred to the general reserve which now amounts to £120,000. In the current assets, the value of stock-in-trade and sundry stocks, at £218,695 is little over £7,000 more than for 1951, but the figure for trade debtors, etc., at £127,102 is over £30,000 higher than the previous year's total.

Radio Rentals Ltd.

Very encouraging news has just been given by Mr. H. F. Hunt, the chairman. In addition to reporting a substantial increase in the trading profit for the year to August 31 last, he states that since the end of the financial year the business done by the group has been very satisfactory. In radio as well as in television the demand for the company's products is today at a higher level than they had ever previously experienced. For the year ended August 31 last the group trading profit is £1,000,459, being an increase of £247,467 on the previous year's total. After charging depreciation, taxation, etc., the net profit of the parent company amounts to £83,697 (*£60,434*). The group current assets at £830,000 is an increase of £268,000, which is spread fairly evenly over the separate items, the rise in the sundry debtors, etc., for instance, at £211,000 being £67,000 above the figure of 1950-51.

Victoria Falls & Transvaal Power Co.

A fourth distribution of 15s. for each £1 Ordinary stock unit held, is being made by the liquidators on February 2 next. They also report that negotiations with the revenue authorities in South Africa have been completed, but negotiations with the revenue authorities in the U.K. and the Rhodesias are continuing with the object of arriving at a final settlement.

Dividend Declared

W. H. Allen, Sons and Co., Ltd. Interim of 5%.

Commercial Information

CONTRACTS OPEN

HOME

Jan. 16.—Leicester. Supply and erection of lamps, columns and fittings and laying cables for lighting of Swannington roundabouts. County Engineer and Surveyor, Grey Friars, Leicester. Deposit £5.

Jan. 16.—Londonderry. Electrical installation at Eglington New School. Documents from Education Office, New Row, Coleraine. Deposit £1.

Jan. 16.—Swinton and Pendlebury T.C. Provision and erection of concrete columns, bracket arms and wiring for street lighting in Station Rd. Also supply of lanterns, lamps and auxiliary equipment for same. (Separate contracts.) Borough Engineer and Surveyor, Town Hall, Swinton. Deposit £2.

Jan. 17.—Baildon U.D.C. Electrical work at Birch Close Farm and Weecher Reservoir Cottage, Bingley. Council's water engineer, Town Hall. Also provision of equipment for six 2-point flashing beacons. Council's Surveyor, Town Hall. Separate contracts.

Jan. 17. — Ennerdale (Cumb.) R.D.C. Supply and installation of 35 mercury street lighting units and concrete columns at Egremont. J. Leigh, Engineer and Surveyor, Council Chambers, Cleator.

Jan. 17. — Horbury (Yorks) U.D.C. Installation of electricity in 243 houses and disconnection of lighting points. Surveyor, Town Hall.

Jan. 17. — St. Neots U.D.C. Provision of nine Stanton concrete columns and Wembley lanterns in Avenue Rd. L. Henderson, Clerk of Council, Council Offices. Huntingdon Street.

Jan. 19.—Plymouth. Supply of flashing beacon assemblies. Town Clerk, Pounds House, Peverell.

Jan. 19.—Winchester. Supply of electric lamps required for year beginning April 1. City Engineer, Guildhall.

Jan. 20.—Birkenhead T.C. List of annual supplies required by Ferries Dept., for year ending March 31, 1954, includes electric lamps. Ferries Manager, Woodside.

Jan. 21.—Blackpool T.C. Provision of three illuminated archways in Preston and Poulton New Rds. and South Promenade, by tungsten and cold cathode lighting. Illuminations and Public St. Lighting Officer, Electrical Services Dept., Rigby Rd. East. (See Jan. 1 issue.)

Jan. 21.—Fareham U.D.C. Electrical fittings included in list of materials required for year ending Mar. 31, 1954. Engineer and Surveyor, Westbury Manor.

Jan. 21.—Hertfordshire. Supply of electric lamps required for year ending March 31, 1954. Documents from Central Purchasing Officer, The Old Rectory, Hatfield.

Jan. 21. — Wandsworth B.C. Supply of 219 lanterns and 213 columns, and erection with all operating gear. Borough Engineer, Municipal Buildings, S.W.18. (See Jan. 1 issue.)

Jan. 22.—Yeovil T.C. Erection of 33 250 W and 77 80 W M.V.E.D. lamps and columns. A. Heal, borough surveyor, Municipal offices, King George Street.

Jan. 23.—Edinburgh. Electrical work in (a) Drylaw Mains Housing Development, and (b) Queensferry Rd. flats. City Architect's Office, City Chambers, Edinburgh.

Jan. 23.—Neath T.C. Supply and erection of three concrete columns, lanterns, sodium lamps, cabling, etc., for Stockham's roundabout. D. Bailey, Borough Engineer, Gwyn Hall. Deposit £2 2s. (See Jan. 8 issue.)

Jan. 24.—Bootle T.C. Supply of electric lamps and other goods during year beginning April 1. Borough Surveyor, Town Hall.

Jan. 24.—Laurencekirk. Electrical work in erection of police station. Applications to County Architect, 34 Market Sq., Stonehaven.

Jan. 24.—Oxford. Supply of electrical equipment for Barton End old people's home. Chief Welfare Services Officer, Greyfriars, Paradise Street.

Jan. 24. — Ruislip-Northwood U.D.C. Supplies required during year beginning April 1 next include electric lamps. Engineer and Surveyor, Council Offices, Northwood, Middx.

Jan. 26.—Carlisle. Electrical installation in 30 houses in Harraby Neighbourhood Unit. City Engineer, 18 Fisher Street.

Jan. 26.—Finchley B.C. Supply of (a) 47 lanterns with 140 W sodium control gear and fuses, and (b) 47 concrete columns. Separate contracts. Borough Engineer and Surveyor, 294-296 Regents Park Rd., Finchley, N.3. Deposit £2 in each case.

Jan. 26.—Runcorn U.D.C. Electric lamps included in list of supplies wanted for year ending Mar. 31, 1954. T. J. Lewis, clerk of council, Town Hall.

Jan. 26.—Rushden U.D.C. Supply and installation of 31 two-tube fluorescent lighting tubes and ten 250 W mercury lanterns, all on concrete columns along Wellingborough Rd. and Church St. Engineer and Surveyor, Council Buildings.

Jan. 26.—Westminster. Tenders invited for supply of electric lamps, cable, etc., during 12 months beginning April 1. Town Clerk, City Hall, Charing Cross Rd., W.C.2.

Jan. 26.—West Riding. Reinstatement of electrical installation at Castleford Whitwood Mining and Technical College. County Architect, Bishopgarth, Westfield Rd., Wakefield. Deposit £2 2s. (See Jan. 1 issue.)

Jan. 26.—Wrexham R.D.C. Wiring for electric light and power in 37 dwellings at Johnstown, 6 at Owersyllt, and 29 at Ruabon. T. A. Bowen, deputy engineer and surveyor, Imperial Buildings, Regent St. Deposit £2 2s.

Jan. 27. — Caithness. Tenders invited for electrical work in 72 houses on various estates—1953 building programme. W. Wilson, County Architect, Wick.

Jan. 27.—Wrexham T.C. Supply of columns, time switches, lanterns and equipment and installation of 102 sodium units and 22 fluorescent units for street lighting on trunk road A483. Borough Engineer and Surveyor, 31 Chester Street. Deposit £2 2s. (See Jan. 1 issue.)

Jan. 28.—Friern Barnet U.D.C. Supply of street lighting lamps

(metal filament, sodium and mercury) for year beginning April 1. Engineer and Surveyor, Town Hall, N.11. (See Jan. 8 issue.)

Jan. 28.—New Mills (Lancs.) **U.D.C.** Group B street lighting installation of 30 lamps in Church and Low Leighton Rds. Documents from Council Surveyor's Office, Town Hall.

Jan. 28.—N. Ireland. Lighting, power and bell installation at Downpatrick General Hospital. J. R. W. Murland, Consulting Engineer, 13 Wellington Place, Belfast. Deposit £5 5s.

Jan. 28.—Scunthorpe T.C. Supply of electric lamps required during year ending Mar. 31, 1954. Cyril Cooper, Borough Engineer and Surveyor, Comforts Ave.

Jan. 30.—Belfast. Wiring for electric light and power and supply of fittings at Stormont Presbyterian Church. Architects are T. T. Houston and Co., 26 College Gdns., Belfast. Deposit £3 3s.

Jan. 30.—Belfast. City's Electricity Dept. is inviting tenders for various materials, including time switches, distribution transformers, cables, switchgear, lamps, washboilers, kettles, etc. Dept. is at East Bridge St., Belfast. Fee 10s. (See Jan. 8 issue.)

Jan. 30. Bethnal Green B.C. Electric lamps included in list of items required during year beginning April 1. F. H. Bristow, Town Clerk, Town Hall, E.2.

Jan. 30.—Haltemprice U.D.C. Supply and erection of two submersible vertical spindle "Fullway" centrifugal pumps (375 gal.p.m.) with electric motors, starters, control gear, etc. Engineer and Surveyor, Anlaby House, Anlaby, E. Yorks. Deposit £2.

Jan. 30.—Leeds. Supply, erection and maintenance of two vertical spindle centrifugal borehole pumps (125 gal.p.m.) with electric motors and switchgear. General Manager and Engineer, Waterworks Dept., Civic Hall.

Jan. 31.—Prestwich T.C. Lamps and other electrical equipment wanted during year ending Mar. 31, 1954. Borough Engineer, Town Hall.

Jan. 31.—Salford. Supply of all kinds of street lighting equipment, including concrete columns, lanterns, lamps, cables etc., required for year beginning April 1. Street Lighting Superintendent, Bloom St., Salford 3.

Jan. 31.—Sevenoaks U.D.C. Re-wiring in screwed conduit throughout swimming and slipper baths. Engineer and Surveyor, Council Offices, Argyle Rd. Deposit £2 2s. (See Jan. 1 issue.)

Jan. 31.—West Lancashire R.D.C. Supply, erection, etc., of 53 sodium lighting units on concrete columns along (approx.) 1,810 yd. of Liverpool-Preston Rd. at Maghull. R.D.C. Office, 52 Derby St., Ormskirk. Deposit £2 2s. (See Jan. 1 issue.)

Feb. 2.—Ormskirk U.D.C. Re-wiring of electrical installation and services at R.N.A.S. Camp, Burscough. Surveyor to Council, Council Offices, Burscough St. (Advertised in this issue.)

Feb. 2.—Salford. Complete electrical installation in 36 flats in Devonshire Rd. City Engineer and Surveyor, Town Hall. (Advertised in this issue.)

Feb. 4.—Poplar B.C. List of supplies required for year beginning April 1 includes electric lamps. Particulars from Town Clerk, Town Hall, Bow Rd., E.3.

Feb. 7.—Swansea T.C. Supply of electric lamps for public lighting for 12 months from April 1. Borough Engineer and Surveyor, Guildhall.

Feb. 16.—Manchester. Re-wiring and additions to electrical installation at Buglawton Hall special school, near Congleton. City Architect, Town Hall. Deposit £1 1s. (Advertised in this issue.)

OVERSEAS

*Details of items marked * may be obtained on application to the Board of Trade, Horseguards Avenue, S.W.1, quoting reference.*

Jan. 30.—Uruguay. Supply of 100,000 mtrs of bare copper conductor, 30,000 mtrs of galvanised steel cable, and accessories for Administracion General de las Usinas Electricas y Telefonos del Estado. B.o.T. (Ref.: CRE 154/53).*

Feb. 4.—S. Rhodesia. Supply of 81 air circuit-breakers between 70 A and 225 A and for 250 V and 600 V for Electricity Supply Commission, P.O. Box 377, Salisbury. B.o.T. (Ref.: CRE 43582/52).*

Feb. 10.—Australia. Manufacture, supply, erection, etc., of four steam turbine-driven pumping units, surface condensers and all necessary auxiliaries for Metropolitan Water Sewerage and Drainage Board, 341 Pitt St., Sydney. B.o.T. (Ref. CRE 43623/52).*

Feb. 13.—Uruguay. Supply of totals of 91,600 mtrs two-wire, and 42,000 mtrs three-wire lead-covered conductors for use with voltage of 250 V. Usinas Electricas y los Telefonos del Es-

Your Queries Answered

"Ekwipoz" adjustable table lamps, makers of? L.L.—Davenport Distributors Ltd., 4 Brook St., London W.1. (24793)

"Onan" generators, agents for? G.E. — Brockhouse Eng. (Southport) Ltd., BMB Products Division, Crossens, Southport, Lancs. (24809)

Instantaneous water heaters, makers of? B.B.—Campbell Eng. Co., Ltd., Sherman Works, Bromley, Kent; Harbrix Industries Ltd., Nelson Place, Rock Ferry, Birkenhead; Poselco Ltd., 39-40, Lancaster Mews, W.2; James Stott and Co. (Engrs.) Ltd., Vernon Works, Oldham. (24813)

"Harab" shavers, agents for? N.W.—Thompson and Capper (Wholesale) Ltd., Speke Hall Rd., Liverpool 19. (24810)

Milliwatt Ltd., makers of bed warmers, address of? H.H.—44 Princess Rd., London N.W.1. (24818)

"Britalux" lighting fittings, makers of? M.E.—General Electric Co. Ltd., Magnet House, Kingsway, W.C.2. (24826)

"D.R.H." fans, makers of? E.B.—Delco-Remy-Hyatt, 111 Grosvenor Rd., S.W.1. (24837)

The above are selected from questions we have answered this week. If you have a query, send it to us.

CONTRACTS OPEN OVERSEAS
—continued

tado, Montevideo. B.o.T. (Ref.: CRE 158/53).*

Feb. 14.—India. Govt. of Travancore Cochin's Electricity Dept. invites tenders for six 110/66 kV transformers for Sengulam, Pallom, and Kundara. Stores Purchase Committee, Trivandrum. B.o.T. (Ref.: CRE 43590/52).*

Feb. 25.—Uruguay. Administracion General, U.T.E., requires diesel generating sets—two identical trailer sets of potential of 100 kW to 120 kW each, and two transportable sets 170 kW to 200 kW. B.o.T. (Ref.: CRE 156/53).*

Mar. 4.—Australia. Supply of 250 compression dead end assemblies for steel cored aluminium conductor for use on 220 kV, 50 c/s, 3-phase, double circuit, steel tower transmission line. Secretary, State Electricity Commission of Victoria, 22-32 William St., Melbourne. B.o.T. (Ref. CRE 43213/52).*

Mar. 17.—India. Supply and erection of all 400, 11,000 and 66,000 V switchgear, transformers, cables and accessories at Ballarpur power station. Madhya Pradesh Electricity Board, New Castle Bldg., Seminary Hills, Nagpur. Fee Rs.75.

Mar. 25.—Australia. State Electricity Commission of Queensland invites tenders for supply of engine-driven electrical generating plant for Balonne Shire Council. Commission is at Scottish Union House, Eagle St., Brisbane. B.o.T. (Ref. CRE 42494/52).*

April 1.—Australia. Manufacture, supply, etc. of nine transformers to various specifications for Townsville Regional Electricity Board. State Electricity Commission of Queensland, Scottish Union House, Eagle St., Brisbane. B.o.T. (Ref.: CRE 43570/52).*

April 8.—Australia. Manufacture, supply, etc., of power cables, control cables and cable fittings for Cairns Regional Electricity Board. State Electricity Commission of Queensland, Scottish Union House, Eagle St., Brisbane. B.o.T. (Ref. CRE 43569/52).*

April 28.—New Zealand. Supply of 400 V switchgear of single busbar indoor metal-clad type for Roxburgh power station. State Hydro-Electric Dept., Wellington. B.o.T. (Ref. CRE 43985/52).*

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	285 0 0	—
LEAD, good soft pig (foreign)	97 15 0	112 0 0
" " "English" quality	99 5 0	
Tin (99·99·76%) (Cash)	955-956	—
" (3 months)	940-942	—
ALUMINIUM, commercial purity (del.)	166 0 0	—
ZINC	88½-89	104 0 0
ARMOURING:		
Galv. Steel Wire (0·104 in.)	53 0 0	—
Mild Steel Tape (0·04 in.)	39 15 0	—

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Roevac Metal Pressings, Ltd. Creditors are asked to send particulars to liquidator, W. A. Walton, 13 Lever St., Piccadilly, Manchester, by Feb. 10. Meetings of members and creditors will take place at that address on Feb. 12 at 11.30 a.m. and 12 noon respectively.

Pathfinder Refrigeration, Ltd. Meetings of members and creditors will be held at 8 Salisbury Sq., Fleet St., E.C.4, on Feb. 13 at 2.15 p.m. and 2.30 p.m. respectively.

BANKRUPTCY ACTS

Application for Discharge

Ipswich. Jack Cooper, mechanical and electrical engineer of Market Place, Orford. Order made on Dec. 10. Discharge suspended for one month.

Appointment of Trustees

London. George H. Watts, electrical engineer trading as Watts and Watts at 185 Stockwell Rd., and 32 Moat Place, S.W.9. Trustee is A. E. Attwood, Acc., 20-21 Lawrence Lane, E.C.2. First meeting at Bankruptcy Building, Carey St., W.C.2, on Jan. 21, at 11 a.m., and public exam. at same address on Feb. 24, at 11 a.m.

Brighton. Alice E. Dalmon and Stanley J. Dalmon trading together as P. Dalmon and Sons, electrical engineers at 60 Teville Rd., Worthing. Trustee is J. S. Eradley-Hole, Cert. Acc., 7 Old Steine, Brighton.

Release of Trustee

Birkenhead. William B. Johnson, trading as Fluorescent Neon Display Co., at 114a Brighton St., Wallasey. Trustee was R. P. Booth, C.A., 5 Rumford Place, Liverpool.

Scarborough. Samuel H. Ireland and Vincent Thomason, trading as Ireland, Thomason and Co., electrical contractors, at 61 Market Place, Malton, and 110 Willowgate, Pickering. Trustee was R. B. Smith, Acc., 3 Alfred St., Leeds.

Receiving Order

Birkenhead. Gordon Towell, electrician trading as Stafford Radio of 183a Grange Rd., Birkenhead. Date of receiving order, Jan. 5.

Dividend

London. Mervyn J. Haine and Mary E. Simpson, trading as electricians at 77 Westbourne Grove, W.2. First and final dividends of 6s. 8d. in £ payable at Bankruptcy Buildings, Carey St. W.C.2, on Jan. 21.

CONTRACTS PLACED

Deptford B.C. Connection of flashing beacons to mains supply, London Electricity Board, £1,013.

Houghton-le-Spring R.D.C. Conversion from gas to electric lighting along A.182 road, B. L. Oliver.

Preston T.C. Electrical installation at Deepdale primary school. Alfred Williams and Son (Preston), Ltd., £1,213.

Rothwell U.D.C. Wiring of 50 houses on Haigh Rd. site, L. Craven, £925.

Rowley Regis T.C. Installation of electrical services in 86 houses in Poplar Ave. and Road. A. H. Armstrong, £1,731.

Sunderland T.C. Supply of equipment for flashing pedestrian crossing beacons, Gowshall, Ltd., £1,008.

Tipton T.C. Provision of Class A street lighting, comprising lamps and columns, along four roads, Midlands Electricity Board, £6,200.

Wakefield R.D.C. Electrical installation in 58 houses, L. Craven, £1,208.

BUSINESS PROSPECTS

HOME

Abercarn U.D.C. Erection of 36 houses at Pant, Newbridge. Council's Surveyor and Engineer, M. T. Benjamin, Council Offices.

Basingstoke T.C. Construction of 50 dwellings on South Ham site. Borough Surveyor, Municipal Buildings.

Belfast. Construction of 46 houses at Dungannon for N. Ireland Housing Trust, 12 Hope Street.

Bentley-with-Arksey (Yorks) U.D.C. Plans of Cementation Co., Ltd., Doncaster, approved for a Rubtex factory.

Bexley T.C. Erection of 350 dwellings in two groups on Lodge Hill estate. Borough Engineer and Surveyor, West Lodge, Broadway.

Braintree. S. E. Dykes-Bower, Quendon Court, Quendon, is architect for rebuilding church of St. Peter-ad-Vinicula.

Brentford and Chiswick. Approval sought for first instalment of Staveley Rd. secondary school, estimated to cost £98,845.

Burton-on-Trent T.C. Six-storey block of 54 flats to be built near New Street bus park.

Calne and Chippenham R.D.C. Advance preparations in hand at Colerne for erection of 42 houses. Council's Engineer, Bewley House, Marshfield Rd., Chippenham.

Coventry. Application to be made for sanction to borrow £1,017,334 for erection of 528 flats at Tile Hill, and 278 houses and 42 bungalows at Bell Green sites.

Croydon T.C. Tenders will probably be invited soon for infants' school at Coldharbour House, stage 2 of Cypress school, and erection of John Ruskin school.

Dagenham. Sketch plans approved for Charlecote secondary technical school. Estimated cost, £208,584.

Dagenham. Plans submitted for new factory on Hainault industrial estate for Chamberlain Industries Ltd., Staffa Rd., E.10.

Doncaster. Kenneth Thelwall Ltd. want to extend factory in Churchill Rd.

Ebbw Vale U.D.C. Erection of block of 3 shops and 2 flats in Cambridge Gdns. Architect to Council, District Council Offices, The Walk.

Enfield. C.C. recommended to approve improvement of lighting in Chase secondary boys' and Chase Side junior schools. Cost estimated at £1,000.

Evesham T.C. Erection of 79 houses in two groups on Fairfield No. 6 site. Council's Architects, Pemberton and Bateman, 21 Vine Street.

Gateshead T.C. Plans prepared for construction of 200 flats at Barn Close.

Huddersfield T.C. Expenditure of £73,964 approved for erection of 46 houses at Newsome and 13 bungalows at Dalton.

Islington B.C. Scheme approved for erection of primary school at Tufnell Park. Total cost estimated at £80,660.

Lisburn. Scheme approved in principle for chest hospital at Brookhill, for N.I. Tuberculosis Authority, costing £2,000,000.

Liverpool. Threlfall's Brewery Co., Ltd., propose to build a residential hotel on corner of Brunswick Street.

London. Lewis, Brooks and Co. Ltd. want to rebuild factory in Bow Common Lane, E.3.

Lowestoft T.C. 1953 building programme will include 32 houses on Whitton estate, 56 in Montgomery Ave. and Hollingsworth Rd., 24 in Normanston Drive and Rotterdam Rd., and 18 flats in Raglan Drive.

Newark R.D.C. Permission to borrow £127,000 sought for erection of 84 houses at Balderton.

Newcastle-on-Tyne. Expenditure of £416,355 approved for erection of 264 three-storeyed flats on Fairways site.

Nuneaton T.C. Erection of 101 houses on Camphill estate. Borough Surveyor, Council House.

Peterborough. Approval received for £65,000 scheme for extensions to grammar school for girls, and the first £20,000 part of the scheme is to be started shortly.

Prudhoe-on-Tyne U.D.C. Work expected to start in spring on erection of first of 660 houses (viz. 160) at West Wylam.

Rochdale. It is proposed to build 350 dwellings on Kirkholt estate.

Selby R.D.C. Erection of 72 houses on nine sites. Architects are Blenkinsopp and Thompson, Clifton Chambers, Park St.

Staveley U.D.C. It is proposed to build 800 houses at Brimington and Woodthorpe.

South Shields. Layout plan prepared for development of Whiteleas area providing for 2,039 houses.

Southwark B.C. It is proposed to build 241 dwellings in development of site near Westmoreland Road.

Twickenham. Licence being sought for erection of £15,000 block of offices in Church St.

Walton and Weybridge U.D.C. Construction of 30 flats in Rydens Rd. Engineer and Surveyor, Council Offices, Walton-on-Thames.

OVERSEAS

Hong Kong. Blair and Co. Ltd., P.O. Box 327, Windsor House, Hong Kong, want to undertake agencies in U.K. for all types of electrical equipment and domestic electrical fittings.

Portuguese W. Africa. Sociedade Electro-Mecanica Lda., Caixa Postal 130, Luanda, Angola, seek sources of supply of diesel- and petrol-driven generating sets, 200-2,000 W, 220 V, 50 c/s, single- and 3-phase.

U.S.A. Quotations from U.K. manufacturers of polished brass lighting fixtures for ceiling and wall application sought by Southern Hardware and Lumber Co., 407 N. Broad St., New Orleans.

TRADE NOTES

Changes of Address. The head office of Parnall (Yate), Ltd., has removed to 255 North Circular Road, London N.W.10. Tel.: Willesden 0076.

From to-day, January 15, the London offices of the Uganda Electricity Board are at 27 Regent Street, S.W.1. Tel.: Regent 0868.

The Birmingham office of Connollys (Blackley), Ltd., is now at 15-17 Spiceal Street, Birmingham 5. Tel.: Midland 2268.

Distributors. G. S. Peckham and Co., Ltd., 3-5 New Compton Street, W.C.2, have been appointed London distributors and stockists of the "Portaway" earthing system by Porter Electrical Products, Ltd., of Leeds.

Nickel. As from January 14, the price of refined nickel in the U.K. was raised to £483 per ton, delivered.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Electroseals Ltd., 24a Leam Terrace, Leamington Spa. Manufacturers of and dealers in apparatus used in the generation, distribution and supply of electricity, etc. Cap.: £2,000. Dirs.: J. R. Sinclair and Mary I. Sinclair.

E.V.S. (Hayes) Ltd., 2 Hurstfield Cres., Hayes, Middx. Repairers, servicers, purchasers and sellers of electrically and internal combustion driven vehicles and accessories, etc. Cap.: £1,000. Dirs.: O. G. Roberts and Mrs. I. G. Roberts.

Foot's Induction Phones Ltd., 1 Upper Richmond Rd., S.W.15. Electricians, radio, television. mechanical and electrical engineers, etc. Dirs. to be appointed by subs. Cap.: £100. Subs.: V. A. Foot, 1 Upper Richmond Rd., S.W.15, and Mrs. C. L. Jacoby, 91 Balfour Rd., N.5.

Gefbar Motors Ltd., 45 Robert Rd., Sheffield. Motor, tractor, agricultural, electrical and general engineers, etc. Cap.: £1,000. Dirs.: G. T. Hukin and B. Elliff.

R. Gilfillan and Co. Ltd., 52 South St., Worthing, Sussex. Exporters, importers, manufacturers of and dealers in radio, telephone and radio equipment. cables, wires, etc. Cap.: £2,000. Dirs.: R. Gilfillan and Margery R. Gilfillan.

R. A. Hall and Co. Ltd., 53 Wood St., Chestergate, Stockport. Electrical and electronic engineers and contractors, etc. Cap.: £200. Dirs.: R. A. Hall and A. Bentham.

Heatlight (Birmingham) Ltd., 11a St. Albans Rd., Watford, Herts. Heating, ventilating and lighting engineers and contractors, etc. Cap.: £500. Dirs.: G. A. Davenport, C. J. Jeffries and F. Gyford.

E. Helliwell (Refrigeration) Ltd., 7 Chesterfield St., Nottingham. To take over business of refrigeration and general engineers carried on as "E. Helliwell and Co." at Nottingham. Cap.: £1,000. Dirs.: E. Helliwell and D. A. Pascoe.

Herbert Senior (Mirfield) Ltd., 3 King St., Mirfield, Yorks. To take over business of electrical, radio and television engineer carried on at Mirfield, Yorks, by H. Senior. Cap.: £12,000. Dirs.: H. Senior and H. H. Senior.

Jell Lamps Ltd., 131 Balham High Rd., Balham, S.W.12. Manufacturers of and dealers in lamps of all kinds, etc. Cap.: £100. Dirs. to be appointed by subs. Subs.: G. Selby, 3 Kenneth Cres., Willesden Green, N.W.2 and Margaret Low.

Goring Kerr Ltd., Rear of 153 High St., Slough, Bucks. Electronic, mechanical and motor engineers, iron and sheet-metal workers, etc. Cap.: £100. Dirs.: D. Hiscock and B. Goring Kerr.

Telemeter Installations Ltd. 119 Victoria St., S.W.1. Electrical, mechanical and general engineers, etc. Cap.: £1,000. Dirs.: C. E. S. Clench, W. Smith, and N. G. Jones.

G. D. Ponsford and Son Ltd. General, civil, mechanical, electrical, structural, heating, refrigerating and motor engineers, etc. Cap.: £100,000. Dir.: W. G. D. Ponsford, 193 Grove Green Rd., Leytonstone, E.11.

P.P.s' Radio and Electrical Engineers Ltd. To take over business of radio and electrical engineers carried on as "P.P.s' Electrical and Radio Engineers" at Langley Mill, Derbyshire. Cap.: £5,000. Dirs.: M. Pearson, L. Pointon and J. H. Hartley.

Ridgecourt Ltd. Designers of mechanical and electrical equipment, instruments and devices; to carry on experimental and research work, etc. Cap.: £5,000. Dirs.: not named. Subs.: W. O. Heyne, Ridgecourt, Woodcote Park, Epsom, Surrey, and B. C. Spicer, Little Trees, The Ridgeway, Stanmore, Middx.

Scott, Healey and Co., Ltd., 349 Harrow Rd., Paddington, W.9. Buyers, sellers, importers and exporters of all classes of goods, accessories, plant, equipment, mechanical and electrical commodities, etc. Cap.: £100. Dirs.: J. Scott and A. H. Healey.

Windings, Ltd., 3 The Gardens, Rayners Lane, Pinner, Middx. Manufacturers of and dealers in domestic, household and general electrical and other equipment and appliances, electrical windings, transformer windings, etc. Cap.: £5,000. Dirs.: A. R. H. MacFarlane, A. E. Smith and W. T. Lunnan.

Stuart and Co. (Canterbury) Ltd., 1/3 St. Peters Lane, Canterbury. Wholesale dealers in and distributors, importers, exporters and manufacturers of electrical goods and equipment, dynamos, etc. Cap.: £5,000. Dirs.: R. S. Cranfield and Mrs. L. M. Cranfield.

H. C. Taylor and Co. (Manchester) Ltd., 54 Mosley St., Manchester 2. Electrical engineers and electrical installation contractors, etc. Cap.: £5,000. Dirs.: C. H. Hodgson and J. Truin.

Kubice Ltd., 4 Bucklersbury, E.C.4. Refrigeration engineers and contractors, etc. Cap.: £2,000. Dirs.: J. R. Phillips and Kathleen Petty.

Telequipment Ltd., 1319a High Rd., Whetstone, N.20. To manufacture television equipment, etc. Cap.: £1,000. Permt. dirs.: E. D. E. Groom, J. A. Coomber and J. C. F. Copps.

Thermorentals, Ltd., York Works, Browning St., S.E.17. Engineers, heating, ventilating and air conditioning engineers, etc. Cap.: £1,000. Permt. dirs.: A. E. Harris and D. R. Harris.

Refrigeration Services (Sutton) Ltd., 24 Coleman St., E.C.2. Cap.: £500. Dirs.: A. J. Goodall and K. J. Goodall.

Richard Threlfall (Sales) Ltd. Bridgeman Place Works, Bolton. Agents for the sale or purchase of and factors of and dealers in engines, motors, dynamos, pumps, castings, tubing, boilers, machinery, etc. Cap.: £1,000. Dirs.: R. Threlfall Hurst, W. Holland, and E. Coates.

William Willman Ltd., 386 Blackburn Rd., Accrington. Electrical engineers; radio, television and electrical appliance dealers, etc. Cap.: £1,000. Dirs: Mrs. D. D. Moore and J. Wallwork.

L. J. and I. W. South (Ryde) Ltd., Clydesdale Works, Simeon St., Ryde, I.o.W. Manufacturers and sellers of wireless, television, electrical, musical and mechanical appliances, etc. Cap.: £1,000. Dirs.: A. J. Taylor, L. J. South and Mrs. I. W. South.

G. Zwicky (London) Ltd., 30 Southampton Buildings, Chancery Lane, W.C.2. Manufacturers of and dealers in electrical and mechanical tools and machines, etc. Cap.: £500. Dirs.. T. Stewart and P. T. Kavanagh:

MEETINGS TO NOTE

THURSDAY, JAN. 15

I.E.S. (Glos. and Cheltenham Centre).—"Electric Organisms and Living Light." J. Ashmore. G.E.C. Ltd., 2 St. Aldgate St., Gloucester, 6.15 p.m.

A.S.E.E. (Kent Branch).—"Estimating for Electrical Contractors." W. H. Brooks. Royal Star Hotel, Maidstone, 8 p.m.

FRIDAY, JAN. 16

A.S.E.E. (S.E. London Branch).—"Supervising Equipment." V. L. Batchelor. S.E. London Tech. College, Lewisham, 8 p.m.

MONDAY, JAN. 19

I.E.E. (London).—Discussion on "Parallel Running of Private Generating Plant with the Grid System." E. R. Wilkinson. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Merseyside and N. Wales Centre).—"Voltage Transformers and Current Transformers associated with Switchgear." W. Gray and A. Wright. Liverpool Royal Instn., Colquitt St., 6.30 p.m.

I.E.E. (Norwich).—"Inherent Current, Voltage and Speed Control in Dynamo-Electric Machinery." J. C. Macfarlane, J. W. Macfarlane and W. I. Macfarlane, Royal Hotel, 7.30 p.m.

BIRMINGHAM ELECTRIC CLUB.—"Fawley Oil Refinery."

E.A.W.—Caroline Haslett Trust Lecture: "Natural Power in Harness: Electricity Aids the Norwegian." Miss M. B. Marris. I.E.E., Savoy Place, 6 p.m.

TUESDAY, JAN. 20

I.E.E. (London Measurements Section).—Discussion on "Measurements of Magnetic Permeability." A. J. King. Savoy Place, 5.30 p.m.

INCORP. PLANT ENGRS. (Glasgow Branch).—"Insulation of Buildings." A. G. Sutton. 351 Sauchiehall St., 7 p.m.

I.E.E. (E. Midland Centre).—"Inherent Current, Voltage and Speed Control in Dynamo-Electric Machinery." J. C. Macfarlane, J. W. Macfarlane and W. I. Macfarlane. Loughborough College, 6.30 p.m.

I.E.E. (N. Midland Utilisation Group).—"Electricity in Newspaper Printing." A. T. Robertson. Y.E.B., 1 Whitehall Rd., Leeds, 6.30 p.m.

I.E.E. (N.W. Utilisation Group).—"Resistance Heating of Mild-Steel Containers at Power Frequencies." C. A. M. Thornton. Engineers Club, Albert Sq., Manchester, 6.15 p.m.

I.E.E. (S.W. Scotland sub-centre).—"Logical Approach to Problems of Electric Space-Warming." D. H. Parry. 39 Elmbank Crescent, Glasgow, 7 p.m.

I.E.E. (S. Midland Supply and Utilisation Group).—"Performance of Natural-Draught Water-cooling Towers." H. Chilton. Imperial Hotel, Birmingham, 6 p.m.

A.S.E.E. (London).—"Role of Electricity in Large Modern Steel Works." 2 Savoy Hill, W.C.2, 6.30 p.m.

DUMFRIES ELECTRICAL SOC.—"Fault Location and Testing on l.v. Mains." Roland B. Thorn. Ewart Library, 7.30 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (N.E. Coast Branch).—"Corrosion in Boilers." J. C. Stainton. Inst. of Mining and Mech. Engrs., Newcastle, 6.30 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (London Graduates and Assoc. Members Section).—"Rubber as it affects the Heating Engineer." F. H. Cotton. Gas Offices, 178 Edgware Rd., W.2, 6.30 p.m.

WEDNESDAY, JAN. 21

I.E.S. (Tees-side Group).—"Light in Aid of Crime Detection." C. H. Edlin. Cleveland Scientific and Technical Inst., Corporation Rd., Middlesbrough, 6.30 p.m.

I.E.S. (N. Lancs Group).—"Contractor Sheds some Further Light." F. Ainscow. Chamber of Commerce, 49a Fishersgate, Preston, 7.15 p.m.

I.E.E. (London Education Circle).—Discussion on Teaching of Electrical and Mechanical Resonance." C. T. Baldwin and J. C. Oakden. Savoy Place, W.C.2, 6 p.m.

INCORP. PLANT ENGRS. (Western Branch).—"The Approach to Maintenance." Colin Troup. Grand Hotel, Bristol, 7.15 p.m.

I.E.E. (S.E. Scotland sub-centre).—"Logical Approach to Problems of Electric Space-Warming." D. H. Parry. Heriot-Watt College, Edinburgh, 7 p.m.

I.E.E. (Southern Centre).—"Post-Graduate Activities in Electrical Engineering." W. G. J. Gibbs, D. Edmunson, R. G. A. Dimmick, and G. S. C. Lucas. University, Southampton, 6.30p.m.

A.S.E.E. (Coventry Branch).—"Grain Drying by Electricity." W. Cover. Technical College, 7.15 p.m.

A.S.E.E. (S.W. London Branch).—Lecturettes by members. Guild House, Worple Rd., Wimbledon.

A.S.E.E. (Manchester Branch).—"Television." H. B. Reeder. Engineers' Club, Albert Sq., 7.30 p.m.

THURSDAY, JAN. 22

INCORP. PLANT ENGRS. (W. and E. Yorks Branch).—"Can there be a National Fuel Policy?" Oliver Lyle. Leeds University, 7.30 p.m.

I.E.E. (London Utilisation Section).—Three short papers. Savoy Place, W.C.2, 5.30 p.m.

INST. OF WELDING (N. London Branch).—"Joining of Aluminium." W. V. Binstead. The Polytechnic, Regent St., 7.30 p.m.

SATURDAY, JAN. 24

JUNIOR INSTN. OF ENGRS. (N.W. Section).—"Hydro-Electric Schemes." F. Burgess. 16 St. Mary's Parsonage, Manchester, 2.30 p.m.

EXHIBITION DIARY

Packaging Exbn. Third show will open at Olympia on Jan. 20. It closes on Jan. 30.

Amusement Trades Exbn. Ninth annual exbn. will take place at Old Royal Horticultural Hall, Westminster, between Jan. 27 and 29.

Hotel and Catering Exbn. opens at City Hall, Deansgate, Manchester, on Feb. 4, continuing until Feb. 14.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller

Louvic. 701,822 Class 11. Electric lamps. V. J. Gould, 6 Brynteg Terr., Trealaw, Rhondda, S. Wales.

Lumor. 712,207. Class 1. Preparations consisting of liquid suspensions of magnetic substances for use in testing magnetisable materials. Manchester Oil Refinery Ltd., Twining Rd., Trafford Park, Manchester 17.

Osmore Q. 711,937. Class 9. Component parts of radio apparatus. Osmore Radio Products Ltd., Bridge View Works, Borough Hill, Croydon.

Philips in design. 711,428 and 711,434. Class 7. Welding machines, etc. 711,429 and 711,435. Class 9. Capacitors, ballasts, etc. 711,430 and 711,436. Class 11. X-ray apparatus, etc. Philips Electrical Ltd., Century House, Shaftesbury Ave., W.C.2.

Remax. 708,682. Class 9. Accumulators, batteries, ammeters, ignition coils, commutators, condensers, cut-outs, connectors etc. Remax Ltd., Remax House, Alfred Place, W.C.1.

Scalamp. 708,216. Class 9. Galvanometers. W. G. Pye and Co., Ltd., "Granta" Works, Newmarket Rd., Cambridge.

Specta-phone. 711,086. Class 10. Hearing aids for the deaf. Fortiphone Ltd., Fortiphone House, 247 Regent St., W.1.

Teletype. 687,698. Class 9. Printing telegraph apparatus. Teletype Corpn., 1400 Wrightwood Ave., Chicago, Illinois.

Telyflo. 709,422. Class 9. Apparatus for indicating, by means of electrical impulses transmitted over a telecommunication system, the flow of a metered commodity. Measurement Ltd., Terminal House, Grosvenor Gdns, S.W.1.

The original D.C. wiring for lights and fans was also carried out in "Henley" some years ago by Messrs. H. HOTZ & CO. the well-known Electrical Engineers and Contractors.

(Photographs by courtesy of Hotz Trust Hotels).

For many years the Hotel CECIL has offered a friendly welcome and excellent cuisine to visitors and guests in the ancient city of Delhi. A recent installation by Henley's Contract Department in India now provides, in summer and winter alike, a tempering of Delhi's extremes of climate.
The installation includes cabling and distribution boards for A.C. supply to serve new air conditioning units and electric heaters in the various Hotel buildings.

Wired throughout with

HENLEY CABLES

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1

WESTON

Electrical Measuring Instruments

No. 7 Miniature Panel Instruments

The range of Weston panel instruments includes DC moving coil, AC rectifier and HF thermocouple types and instruments of the moving iron type. They are available in case diameters of 2", 2½" and 3½". Spring-loaded jewels protect the pivots from even the most severe shocks. Full details of these instruments will gladly be supplied on request together with information on the full Weston range, which includes switchboard, portable, sub-standard, and laboratory standard instruments.

SANGAMO WESTON LIMITED

Enfield, Middlesex. Tel: Enfield 3434 (6 lines) & 1242 (4 lines). Grams: Sanwest, Enfield

Branches: Glasgow, Manchester, Newcastle-on-Tyne, Leeds, Liverpool, Wolverhampton, Nottingham, Bristol, Southampton, Brighton

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WORK WANTED WANTED · FOR SALE

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

ORMSKIRK URBAN DISTRICT COUNCIL

RE-WIRING OF ELECTRICAL INSTALLATION
R.N.A.S. Camp, Higgins Lane, Burscough.

TENDERS are invited for the re-wiring of the electrical installation and services of the R.N.A.S. Camp, Burscough. Specification obtainable from the Surveyor to the Council, Council Offices, Burscough Street, Ormskirk. Sealed tenders, endorsed "Electrical Works, R.N.A.S. Camp" to be returned to the Clerk of the Council by 10 a.m. on February 2, 1953. Lowest or any tender not necessarily accepted.

JOSIAH TAYLOR,
Clerk of the Council.

Council Offices,
Burscough Street, Ormskirk.
January 6, 1953. (C 344)

CITY OF MANCHESTER

THE EDUCATION COMMITTEE invite tenders for REWIRING and ADDITIONS to electrical installation at Buglawton Hall Special School, near Congleton, Cheshire. Specification and tender form may be obtained from the City Architect, Town Hall. Deposit £1 1s. (returnable). Tenders, sealed in endorsed envelopes, must be delivered before 10 a.m., February 16, 1953.

PHILIP B. DINGLE,
Town Clerk.
January 7, 1953. (C 360)

CITY OF SALFORD

TENDERS ARE INVITED by the first post, Monday, February 2, 1953, for the complete ELECTRICAL INSTALLATION in 36 Flats, Devonshire Road, Salford, 6.

Specifications and Tender Forms may be obtained on application to the City Engineer and Surveyor, Town Hall, Salford, 3, Lancs.

H. H. TOMSON,
Town Clerk.
(C 403)

BOROUGH OF WREXHAM

TRUNK ROAD GROUP "A" STREET LIGHTING
Wrexham.

TENDERS are invited for the SUPPLY ONLY of Columns, Time-switches, Lanterns and Equipment and/or the INSTALLATION of 102 No. 140 watt Sodium Lighting Units and 22 No. Triple 80-watt Fluorescent Lighting Units on Trunk Road A.483 within the Borough.

Drawings and Conditions of Contract may be inspected at the Office of the Borough Engineer and Surveyor, 31 Chester Street, Wrexham, from whom copies of the Specification and forms of Tender may be obtained on payment of a deposit of two guineas, which will be refunded on receipt of a bona fide Tender.

Tenders in the appropriate plain envelope sealed and endorsed "Trunk Road Lighting" should reach the undersigned not later than noon on Tuesday, January 27, 1953.

The Council do not bind themselves to accept the lowest or any Tender.

PHILIP J. WALTERS,
Town Clerk.
Guildhall, Wrexham.
December 24, 1952. (C 269)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Salary, inclusive of London allowance, and conditions of service in accordance with N.J.B. Schedule "A" or "C."

DEPUTY STATION SUPERINTENDENT
Hackney Generating Station.

Candidates should have received a sound technical and practical training, and had extensive experience in operation and maintenance of a large generating plant. They must also possess good administrative organising and managerial abilities and have experience of labour relations. Salary, Class "F," Grade 3, £968 16s. p.a.

ASSISTANT BOILER-HOUSE SHIFT CHARGE ENGINEER
Barking "A" and "B" Generating Stations.

Qualifications: Sound technical education up to Higher National Certificate standard and experience with modern boiler-house operation, including pulverised fuel. Salary, Class "M," Grade 11, £793 16s. p.a.

ASSISTANT ENGINEER (SHIFT)
Barking "A" and "B" Generating Stations.

Qualifications: Sound technical education up to Higher National Certificate standard and experience in the operation of E.H.T. switchgear, station auxiliaries and the control of large turbo-alternators. Duties of successful applicant will be those of first assistant to the Station Shift Control Engineer. Salary, Class "M," Grade 12, £740 5s. p.a.

ASSISTANT SHIFT CHARGE ENGINEERS
Barking "C" Generating Station.

Qualifications: Higher National Certificate or equivalent and preferably be members of one of the recognised Institutions. Candidates should have had extensive experience in the operation of modern high-pressure turbine and boiler plant, E.H.T. switchgear and the administration and control of labour. Salary, Class "J," Grade 9, £754 19s. p.a.

APPRENTICES' INSTRUCTOR

Applications are invited for this position at the Apprentices' Training School, which is being equipped at the Bankside Generating Station, S.E.1. Candidates should have sound practical and technical mechanical engineering training, and experience of workshop practice in mechanical engineering. They must be able to demonstrate their ability to impart instruction, and teaching experience is therefore desirable. Candidates must be able to prepare a syllabus for the course of instruction, plan the work, lecture and give practical instruction. They will be required to carry out instruction in all the basic mechanical engineering skills and to enable apprentices to acquire the elements of the blacksmiths' and welders' techniques, and proficiency in the operation of machine tools. Salary, Class "AX'EX," Grade 5 (Third Assistant Engineer), with an ultimate salary of £927 3s. p.a. Commencing salary will be in accordance with qualifications, but will not be less than £740 5s. p.a.

Applications must be made on the form obtainable from Divisional Secretary, B.E.A., London Division, Generation House, Great Portland Street, W.1, and be returned within 14 days of this advertisement. (C 390)

HERTFORDSHIRE COUNTY COUNCIL

County Architect's Department

ASSISTANT ELECTRICAL ENGINEER, Grade VI, £670-£735. Applicants should be A.M.I.E.E., or equivalent, and need not have had previous Local Government experience.

Applications, with names and addresses of three referees to the County Architect, County Hall, Hertford, Herts, by January 27, 1953. (C 374)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

LITTLEBROOK POWER STATION
(480 MW)

APPLICATIONS are invited for the following positions:

(a) MAINTENANCE ENGINEER

Applicants should be Corporate Members of the Institution of Mechanical and/or Electrical Engineers, or possess an engineering degree, with extensive experience in the maintenance of high pressure turbine and boiler plant, electrical plant and all power station auxiliary plant. Experience in administration is essential.

(b) ASSISTANT ENGINEER (MAINTENANCE)

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications. Experience in maintenance of mechanical and electrical plant with particular reference to the maintenance of alternators, switchgear, transformers, electrical auxiliaries etc., in a large modern power station is essential, as is experience in administration and control of labour.

(c) ASSISTANT ENGINEERS (PLANNING)

Applicants for the above positions should possess sound technical knowledge and be familiar with the operation and maintenance of one of the following:

(i) Turbines and auxiliary plant, C.W. plant, civil works, cranes and lifting gear and workshops.
(ii) Boilers and ancillary boiler house plant.
(iii) Coal and ash handling plant.
or (iv) Electrical plant and instruments.

and will be responsible for the control and planning of the maintenance in connection with the above sections of plant.

(d) STATION CHEMIST

Applicants should possess B.Sc. or equivalent qualification in chemistry and have had experience in the analysis and testing of coal and water and in dealing with boiler fouling and water corrosion problems associated with high pressure and high temperature steam generating plant. Experience in the control of staff is also required.

(e) ASSISTANT ENGINEER (Operation and Efficiency)

Applicants who should preferably possess an engineering degree or similar qualification will be required to assist the Station Operation and Efficiency Engineer in the examination of station performances and the determination of station operation and maintenance policy, and will be responsible for the control of staff dealing with the day to day work relating to station efficiency.

(f) ASSISTANT SHIFT CHARGE ENGINEERS

Technical qualifications equivalent to Graduate Membership of either the Institution of Mechanical or Electrical Engineers. Experience in the efficient operation of modern high pressure power station plant with P.F. firing, essential. Candidates should have had experience in the administration and control of labour.

(g) ASSISTANT ENGINEER (HANDLING)

Applicants who should possess a knowledge of shipping, coal storage and its associated problems, will be responsible for the operation of the coal and ash handling plant and associated equipment, including mobile equipment. Experience in the control of labour is essential.

(h) ASSISTANT ENGINEER (HANDLING—SHIFT)

The successful applicant, who must be capable of controlling labour, will be responsible on shift of the coal and ash handling plant and associated equipment, including mobile equipment.

N.J.B. conditions of service and salary inclusive of London Weighting:
(a) Class "M" Grade 6, £1,113 p.a.
(b) (f) and (g) Class "M" Grade 9, £906 3s. p.a.
(c) and (h) Class "M" Grade 12, £750 5s. p.a.
(d) Class "M" Grade 7, £1,035 6s. per annum.
(e) Class "M" Grade 8, £968 2s. p.a.

Applications on forms obtainable from Station Superintendent, Littlebrook Power Station, near Dartford, Kent, should be returned to him by not later than January 26, 1953. (C 389)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

COMMERCIAL ASSISTANT required in the Warrington District. Salary £548 to £565 p.a. (N.J.B. F 11). Applicants must have received a thorough technical training and should possess the qualifications to enable them to become Chartered Electrical Engineers.

Duties include estimating for contracting work, advising consumers on matters relating to electricity supply and consuming appliances, etc.

The appointment is superannuable and subject to medical examination.

Standard application forms obtainable from the Manager, No. 2 Sub-Area, Electricity House, Sandiway, near Northwich, Cheshire. Closing date, February 2, 1953. Please quote reference number 97S. (C 393)

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Ayrshire Sub-Area

APPLICATIONS are invited for the undernoted engineering appointment at Sub-Area Headquarters, Kilmarnock, which is superannuable.

SENIOR ASSISTANT ENGINEER

Meters, Testing, Protection and Communications

Applications are invited from qualified engineers for the position of Senior Assistant Engineer at Sub-Area Headquarters, Kilmarnock.

Candidates should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications and should have wide knowledge and experience of:—

1. Metering practice, testing and repairs.
2. Testing of distribution equipment and fault location.
3. Modern protective systems.
4. Communications, supervisory and remote control systems.

Salary in accordance with N.J.B. Agreement, Schedule "A," Class "G," Grade 4, £905 to £944 per annum.

Forms of application may be obtained from the undersigned or any other Sub-Area Manager, and should be returned to me duly completed with any additional information not later than January 26, 1953.

A. E. ROOTS,
Manager.

Greenholm Street,
Kilmarnock.
January 6, 1953. (C 358)

COUNTY BOROUGH OF BLACKPOOL

APPOINTMENT OF TECHNICAL ASSISTANT

APPLICATIONS are invited for the superannuable appointment of a Technical Assistant APT.II (£495 by £15 to £540) in the Electrical Services Department. The post is subject to special conditions as to office hours, particulars of which may be had on application.

The candidate must be experienced in draughtsmanship and have knowledge of electricity distribution and lighting techniques.

Applications, giving particulars of age, present position, qualifications and experience, including names and addresses of two referees, to be forwarded to the Illuminations and Public Street Lighting Officer, Electrical Services Department, Rigby Road East, Blackpool, to reach him not later than January 24, 1953.

Canvassing of, or the submission of the names of, members of Council as referees will disqualify candidates.

TREVOR T. JONES,
Town Clerk.
(C 387)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPOINTMENT OF SECRETARY

APPLICATIONS are invited from suitably qualified candidates for the post of Secretary of the Merseyside and North Wales Electricity Board. The appointment is superannuable and will be on the salary scale of £2,200 rising by annual increments of £100 to £2,500 per annum.

Letters of application, stating age, present appointment and salary, and giving full particulars of qualifications, experience, etc., together with the names of two referees, should be forwarded to the Chairman, Merseyside and North Wales Electricity Board, Electricity House, Love Lane, Liverpool 3, so as to reach him not later than January 31, 1953. Envelopes should be endorsed "Secretary." (C 410)

CROWN AGENTS FOR THE COLONIES

MASTER, TECHNICAL EDUCATION (ELECTRICIAN) required for the Gold Coast Local Civil Service for two tours each of 18 to 24 months in first instance. Commencing salary according to age, qualifications and experience in consolidated scale £990 rising to £1,230 a year (including overseas pay). Outfit allowance £60. Gratuity payable on satisfactory completion of final service at the rate of £25, or £37 10s., according to salary for every completed period of three months. Free passages. Liberal leave on full salary. Candidates must possess an ordinary National Certificate or a City and Guilds Final Certificate in Electrical Engineering or an equivalent qualification and have had good industrial experience.

Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London S.W.1, quoting on letter M.29142.B. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. (C 394)

SOUTHERN ELECTRICITY BOARD

SENIOR DRAUGHTSMAN (CIVIL ENGINEERING)

NO. 1 (SOUTHALL) Sub-Area Office. Salary, N.J.B. Schedule "D," Grade 5 (£595 7s. to £704 11s. p.a., inclusive of London allowance). N.J.B. conditions of service.

Applicants should have had training and experience in building construction and the design of steelwork and reinforced concrete structures, and be capable of preparing drawings and making calculations.

Applications, on forms obtainable from the Sub-Area Secretary, 2/6 Windmill Lane, Southall, Middlesex, and returned to him in envelopes suitably endorsed, not later than January 26, 1953.

JUNIOR ENGINEERS

Aldershot District of No. 3 (Portsmouth) Sub-Area. One located at Aldershot and one at Petworth. Salary, N.J.B., Class "F," Grade 15, Column 1 (£390 p.a.). N.J.B. conditions of service.

Applicants should have experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution equipment, and possess suitable technical qualifications. The appointments will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed, not later than January 26, 1953.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible. (C 392)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for appointments as ASSISTANT SECTION ENGINEER in the following Districts of the Board:—

(1) Liverpool North District. Salary, N.J.B. "G.9" (£641 to £667 p.a.). Application forms from Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3.

(2) Chester District. Salary, N.J.B. "E.9" (£587 to £600 p.a.). Application forms from Manager, No. 3 Sub-Area, Newgate Street, Chester.

(3) Caernarvon District—Pwllheli: Salary N.J.B. "E.9" (£587-£600 p.a.). Application forms from Manager, No. 4/5 Sub-Area, Rhostyllen, near Wrexham.

Applicants must have received a thorough technical training, should possess the qualifications to enable them to become Chartered Electrical Engineers, and should have had operational experience of h.v. and l.v. networks, including substations. In the case of post (3), ability to speak Welsh would be an advantage.

Appointments superannuable and subject to medical examination.

Closing date for applications: January 26, 1953. Please quote Reference 96A. (C 361)

BRITISH ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 3/53.

APPLICATIONS invited for the following superannuable N.J.B. appointments:—

1. DEPUTY STATION SUPERINTENDENT, Tir John Power Station, Swansea. H.3, £1,035 to £1,081 p.a.

2. DEPUTY STATION SUPERINTENDENT, Llynfi Power Station, Nr. Aberkenfig. G.3, £971 to £1,014 p.a.

Corporate membership of the Institution of Mechanical and/or Electrical Engineers desirable, and wide experience of operation, maintenance and administration of a modern generating station essential.

Application forms, obtainable from Divisional Secretary, British Electricity Authority, South Wales Division, Cardiff (Pengam Moors) Airport, Cardiff, should be returned by February 2, 1953. After January 17, address will be British Electricity House, Twyn-y-Fedwen Road, Gabalfa, Cardiff. (C 391)

LONDON ELECTRICITY BOARD

ENGINEER (TEST)

APPLICATIONS are invited for the above position in the Meter and Testing Branch of the Western Sub-Area based at Fulham, S.W.6.

Applicants should have had a sound general education, and preferably possess an engineering degree or Higher National Certificate of Electrical Engineering. They should have served an apprenticeship with a large engineering manufacturer or supply undertaking, and have had experience in general electrical testing and in the testing of protection apparatus.

The post is graded under Schedule "A" of the National Joint Board agreement as Class "L," Grade 13—£646 16s. per annum rising to £678 6s. per annum, inclusive of London Allowance.

Application forms from Establishments Officer, 46 New Broad St., E.C.2, to be returned completed by January 26, 1953. Please enclose addressed envelope and quote ref.: V/1539/T. on all correspondence. (C 347)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

Chilterns Sub-Area

Luton District

DISTRICT COMMERCIAL ENGINEER. 5/53.R.

Candidates should preferably be Corporate Members of the Institution of Electrical Engineers and have had wide practical experience. The successful candidate will be responsible to the District Manager for all commercial aspects of a large district having an important industrial, agricultural, commercial and domestic consumer population, and should be capable of dealing with problems arising from electrical contracting and maintenance, tariffs, rural and industrial extensions and an active sales programme, together with supervision of commercial staff. Ability to drive a car will be an advantage.

The provisional annual salary for the appointment will be £900.

Candidates who have previously submitted applications for the recently advertised positions of Senior Assistant Engineers in the Commercial Department of the Chilterns Sub-Area and who wish to be considered for this position need not re-apply, but will be considered if an intimation to this effect is received before the closing date for applications.

Apply to the District Manager—Luton, Eastern Electricity Board, 487 Dunstable Road, Luton, Beds.

Bedford and Watford Districts.

ASSISTANT COMMERCIAL ENGINEERS (Industrial Power). 7/53N.

Candidates for both posts must have experience of tariffs associated with industrial and commercial consumers and must be able to advise on and estimate for installations in such consumers' premises, including power factor correction. A knowledge of street lighting would be a particular advantage. Preference will be given to those holding the Higher National Certificate in Electrical Engineering.

The provisional annual salary for both posts will be £600.

Apply to the District Manager concerned at either of the following addresses:

District Manager—Bedford, Eastern Electricity Board, Prebend Street, Bedford.

District Manager—Watford, Eastern Electricity Board, The Parade, High Street, Watford.

Previously advertised in September, 1952, under reference No. 36/52.R. Applications submitted on that occasion will automatically be reconsidered.

Northmet Sub-Area

Harrow District.

SENIOR SALES REPRESENTATIVE. 6/53R.

The duties will consist of giving advice on supply matters, tariffs, apparatus and sales to consumers with domestic or small commercial or industrial installations.

The salary will be in accordance with Grade 2 (£460 by £20 to £520 per annum) of the National Joint Council Salary Agreement plus London Weighting.

Apply to the District Manager—Harrow, Eastern Electricity Board, Electricity Offices, College Road, Harrow, Middlesex.

Future salaries and conditions of service for the above appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter, stating age, education, qualifications and experience with details of present appointment and salary should be submitted to the Manager concerned within 14 days of the appearance of this advertisement. (C 388)

BRITISH ELECTRICITY AUTHORITY

South West Scotland Division

ASSISTANT SHIFT CHARGE ENGINEER

Braehead Generating Station.

APPLICATIONS are invited for the position of Assistant Shift Charge Engineer at Braehead Generating Station for which the salary will be within the range £680 to £706, this being in Class "H," Grade 9 of the National Joint Board Schedule.

Applications on Form A.E.6, which may be obtained from the Authority's Headquarters or from any Divisional Office of the Authority should be forwarded to the Divisional Secretary, 168 Broomhill Drive, Glasgow, W.1 before February 2, 1953.

A. CHRISTIANSON,
Divisional Secretary.

December 30, 1952. (C 346)

GOLD COAST GOVERNMENT

VACANCIES FOR ELECTRICAL ENGINEERS
Electricity Department

APPLICATIONS are invited for vacancies in the post of Electrical Engineer in the Electricity Department.

Duties will include the complete investigation and planning of new electricity undertakings and the expansion of existing undertakings; the preparation of schedules and the supervision of contracts.

Qualifications. Candidates should be corporate members of the Institution of Electrical Engineers or possess equivalent qualifications. They should have been regularly trained as electrical engineers and have had a wide subsequent experience with an electricity supply authority in design and construction of e.h.t. and l.t. underground and overhead distribution systems. A knowledge of compression ignition engines would be an advantage.

Terms of Service. The appointments will be on contract-gratuity terms for one tour of 18-24 months with a possible extension to two tours. Salary will be in the range £810-£2,020 per annum (consolidated) according to age, qualifications and experience. A gratuity at the rate of £37 10s. (or £25, if salary less than £1,000) for each completed three months of satisfactory service will be payable on final termination of the contract.

Free passages on first appointment and on leave will be provided for the officer and his wife once each way during each tour of service. Officers will normally be required to travel by air. Free air passages will also be provided for a maximum of 3 children under 13 years of age.

Vacation leave with pay: six days for each month of service. Free medical and dental attention provided for officer and family. Furnished quarters available at low rental. Income tax at low local rates. Kit allowance on first appointment £30-£60 according to salary.

Contributions to the Widows' and Orphans' Pension Fund are at present compulsory.

These posts are "Development Posts" for implementation of specific projects under the Gold Coast Development Plan and are strictly temporary. On termination of the contract, the officer would not be eligible for transfer to any other Government appointment but would be able to apply for appointment to another post, if desired.

Intending candidates should apply to the Gold Coast Commissioner, Melbourne House, Aldwych, London, W.C.2, for application forms. (C 369)

CITY OF BIRMINGHAM PUBLIC WORKS DEPARTMENT

APPLICATIONS are invited for the post of ELECTRICAL ENGINEERING ASSISTANT in the Mechanical and Lighting Section.

Applicants must have passed Section "A" of the Institution of Electrical Engineers Associate Membership Examination or obtained the Higher National Certificate (Electrical Engineering), and should have had experience with an electrical contractor in the design of electric lighting, power and heating installations for public buildings and institutions.

Salary—Grade A.P.T. IV (£555 to £600 per annum) in accordance with qualifications and experience.

The post is permanent, superannuable, subject to a medical examination and to one month's notice on either side.

Applications endorsed "Electrical Engineering Assistant," stating age, qualifications and experience together with the names of two persons to whom reference can be made, should reach the undersigned not later than January 31, 1953.

Canvassing disqualifies.

HERBERT J. MANZONI,
City Engineer and Surveyor.

Civic Centre, Birmingham 1. (C 348)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following positions:—

TEST ENGINEER (STEAM),
Divisional Headquarters, Portsmouth.

Applicants should possess a thorough knowledge of thermo-dynamics and be experienced in the determination of efficiency and losses occurring in large turbines and condensing plant. A sound knowledge of boiler testing is also required, and applicants should be well acquainted with all instruments employed in this work. Plant operating experience will be an advantage. Applicants should preferably be corporate members of one of the senior professional Institutions.

Salary: N.J.B. AX/CX2, £834 to £1,025.

Application forms, obtainable 1 om P. D. A. Oliver, Esq., Divisional Secretary, British Electricity House, 111 High Street, Portsmouth, must be returned by January 28, 1953. (C 405)

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

No. 1 (Bradford) Sub-Area

SENIOR ASSISTANT ENGINEER
(Construction and Maintenance)

Applicants should have substantial experience in the construction and maintenance of overhead and underground transmission and distribution systems, with associated sub-stations operating at pressures up to 66 kV. They must be able to arrange, co-ordinate and progress such works.

Applicants should be corporate members of the Institution of Electrical Engineers or hold other approved technical qualifications.

Salary, N.J.B., Class "K," Grade 4, £1,093-£1,141 per annum.

Applications, giving full details of age, qualifications and experience, should be forwarded to the Manager No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Road, Bradford, not later than January 25, 1953.

No. 4 (Leeds) Sub-Area

DISTRICT CONTROL ENGINEER

Applications are invited for the post of District Control Engineer in the Leeds System Control Room, controlling the distribution network in the city.

Applicants should possess technical qualifications equivalent to those for corporate membership of the Institution of Electrical Engineers and have sound practical experience on a large urban network up to 33 kV especially with the operational functions. A comprehensive knowledge of all relevant safety regulations applicable to electricity supply is essential. Experience of rural network operation and a supervisory controlled system would be an advantage.

The duties will be on a five cycle shift rota in accordance with the N.J.B. agreement.

Salary, N.J.B. Class "J," Grade 9, £719-£750 per annum.

Applications, giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than January 29, 1953. (C 373)

BRITISH ELECTRICITY AUTHORITY

North Western Division

VACANCY NO. 856—MAINTENANCE ENGINEER (ELEC.), Stuart Street Generating Station. Salary £833 to £866 (N.J.B. Grade 6, Class "H"). Candidates should preferably be corporate members of the Institution of Electrical Engineers or holders of an equivalent qualification, and should have had wide experience of power station electrical equipment and practical experience of E.H.T. switchgear and protective gear.

Apply to Establishments Officer, British Electricity House, 825 Wilmslow Road, Manchester 20, before January 24. Quote vacancy No. (C 345)

SOUTH WALES ELECTRICITY BOARD

REQUIRED, THIRD ASSISTANT (Industrial Supply) in the Commercial Department of the West Central Sub-Area of the Board at Fforestfach.

Duties involved include assistance in the negotiation of important supplies to industry, general development of the industrial load and advice to industrial consumers upon utilisation of electricity.

Salary in accordance with Class "K" Grade 10 (£719/£734/£750) of the N.J.B. Schedule.

Applications stating age, present position and salary, qualifications and experience and giving three referees, to be addressed to the Secretary to arrive by January 23, 1953.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (C 386)

BRITISH ELECTRICITY AUTHORITY

South Western Division

ENGINEERING DRAUGHTSMAN

Transmission Department, Divisional Headquarters, Bristol

SALARY, N.J.B., Schedule "D," Grade 6, £433 to £567. Duties mainly concerned with preparation of connection diagrams for switchgear and associated equipment. Experience in layout and site drawings for outdoor substations considered an advantage.

Above appointment superannuable.

Application forms obtainable from the Divisional Secretary, 26 Oakfield Road, Bristol 8, to be received not later than January 30, 1953. (C 362)

HER MAJESTY'S COLONIAL SERVICE

APPLICATIONS are invited for the following posts:—

Vacancies for (a) a SENIOR SIGNALS OFFICER (CDE 98/14/01), Aviation Department, Nigeria. Duties of (a) are to assume executive control of and to maintain the aeronautical mobile telecommunications and radio navigational aid equipment at Kano and Lagos airports; to supervise the signals staff, maintain liaison with the Posts and Telegraphs Department, and ensure the co-ordination of telecommunication procedure. Also to act as adviser to the Director of Civil Aviation on telecommunications matters. Officer appointed will be stationed at Lagos. Duties of (b) are to maintain all aeronautical mobile telecommunications and radio navigational aid equipment at Department of Civil Aviation aerodromes in Nigeria and to be responsible for ensuring that I.C.A.O. procedures and practices are observed. Officers appointed will be stationed at either Lagos or Kano.

Appointment is either pensionable, on probation, in the scale of £830 to £1,560 per annum (Senior Signals Officer will be appointed at £1,400 per annum or above), or on contract in scale £895 to £1,719 per annum (minimum for Senior Signals officer being £1,513 per annum); the point of entry depending on war service and approved experience. In addition a substantial gratuity is payable on satisfactory completion of a contract appointment.

Free first-class passages are provided for the officer and his wife, once each way each tour.

Government quarters are provided, if available, at a low rental, and income tax is payable at low West African rates. Leave is granted at the rate of seven days for each month of residential service.

Candidates must be A.M.I.E.E. or have taken or be exempted from Sections A and B of the examination for Associate Membership provided they attain Corporate Membership within three years, or have a 1st or 2nd class honours degree in Engineering or Physics. Previous experience with aeronautical telecommunications equipment is desirable. A knowledge of modern theory and practice of radio and electricity and its application to air navigation, with particular reference to the procedures and other requirements of the International Civil Aviation Organisation is necessary.

Intending candidates should apply in writing to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1, giving brief details of their age, qualifications and experience. They should mention this paper and quote the reference number shown against the post for which application is made. (C 359)

A. REYROLLE & CO., LTD., have vacancies for CONTRACTS ENGINEERS at Hebburn for both home and export work with opportunities for appointment overseas. The work combines technical and commercial activities on switchgear for all voltages and offers considerable scope.—Applicants should write, giving details of their technical qualifications and experience, together with the salary required to the Contracts Manager, A. Reyrolle & Co., Ltd., Hebburn, Co. Durham. (C 275)

BRITISH ELECTRICITY AUTHORITY, Generation (Plant Design) Sub-Branch. ENGINEER-IN-CHARGE of General and Co-ordination Section required at Headquarters, London. Duties will be to take charge of a section of specialist engineers dealing with the technical and economic aspects of certain ancillary equipment in power stations, including pipework and valves, instrumentation and controls and fire-fighting equipment; also to collaborate, for co-ordination purposes and with responsibility for the final drafting of collective reports, with the engineers-in-charge of four other specialist sections, dealing respectively with boiler plant, turbine, condensing and feed-heating plant, electrical plant and mechanical handling plant. Candidates should preferably have an Honours Degree in engineering and wide general knowledge of large power station plant practice; specialised knowledge of any particular branch is not necessary. Salary not less than £1,504 inclusive.

Forms from D. Moffat, Director of Establishments, British Electricity House, Winsley Street, W.1, to be returned by February 2, 1953. Quote reference AE.307. (C 351)

CABLE laying and installation CONTRACTS ENGINEER, experienced in price estimating, supervision of site work, including jointing and labour, required for responsible position offering scope for advancement.—Applications, with full details of education, training and subsequent experience, with appropriate dates, to Box No. 2317, Electrical Times. (C 377)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

BRITISH ELECTRICITY AUTHORITY, Generation Operation. SENIOR ASSISTANT CO-ORDINATING ENGINEER (Plant Operation) required at Operational Headquarters, London. Candidates should be corporate members of the I.Mech.E. or I.E.E., or have equivalent qualifications. Senior responsibility in management and operation of modern power stations and experience of boiler, turbine and auxiliary plant maintenance is essential. Salary N.J.B., Grade 1, £1,002-£1,378 inclusive.

Applications, stating age, qualifications, experience and salary to D. Moffat, Director of Establishments, British Electricity House, Winsley Street, London W.1, not later than February 2, 1953. Quote ref. AE.310. (C 371)

BRITISH ELECTRICITY AUTHORITY. Production Inspection and Test Sub-Branch, require a SECOND ASSISTANT ENGINEER (Electrical) in the Manchester Regional Office. Candidates should be corporate members of the I.E.E., or hold equivalent qualifications and must have considerable experience in the production inspection and testing of heavy industrial (power station) plant in manufacturers' works. Salary, N.J.B., Grade 3, £800-£1,159.

Applications, stating age, qualifications, experience, present position and salary to D. Moffat, Director of Establishments, British Electricity House, Winsley Street, London W.1, by February 2, 1953. Quote Ref. AE.311. (C 380)

BRITISH ELECTRICITY AUTHORITY. PRODUCTION INSPECTION and TEST ENGINEER required in the Generation Construction Sub-Department at Headquarters, London. The successful candidate will be responsible through the Generation Construction Engineer to the Deputy Chief Engineer (Construction) for the administration of the Production Inspection and Test organisation of the Authority both at Headquarters and in seven Regional Offices throughout the country. Candidates should have wide experience of modern large-scale industrial production methods and procedures for the inspection and testing of large items of plant and corporate membership of a related engineering institution or equivalent qualifications. Preference will be shown to candidates with knowledge of the manufacture of the main plant items associated with large modern power stations. Salary within provisional range £1,500-£1,750 inclusive.

Applications, stating age, qualifications, experience, present appointment and salary to D. Moffat, Director of Establishments, British Electricity House, Winsley Street, London W.1, by February 2, 1953. Quote Ref. AE.312. (C 381)

DRAUGHTSMEN, Ewbank and Partners, Ltd., have vacancies for Mechanical Engineering Draughtsmen experienced in power station design layout, pipework layout, circulating water systems, with some knowledge of coal and ash-handling plant. The positions are permanent and pensionable, free lunches are provided and a five-day week is in operation.—Applicants should write in the first instance, stating age, details of experience and salary required, to the Secretary, Ewbank and Partners, Ltd., Engineering Consultants, 10/11 Grosvenor Place, London S.W.1. (C 364)

ELECTRICAL INSPECTOR required by Frigidaire. Experience of f.h.p. motors essential, knowledge of A.I.D. procedure an advantage.—Call, phone or write, Personnel, Stag Lane, N.W.9 (Colindale 6541). (C 368)

ELECTRONIC ENGINEER to look after 90 kW radio frequency generator. Must be conversant with maintenance procedure for high power water cooled valves. Permanent position near Colchester.—When applying give full details to Box No. 2319, Electrical Times. (C 378)

EXPERIENCED TRANSFORMER ENGINEERS are required by the English Electric Company Limited, to form the nucleus of a section designing power transformers up to 10,000 kVA up to 66 kV in their new Liverpool factory. Applicants should be graduates of a British university, corporate members of the Institution of Electrical Engineers, and experienced in all the latest techniques of transformer engineering, including impulse testing.—Please reply giving full details of experience and qualifications to Central Personnel Services, The English Electric Company Limited, 336/337 Strand, London, W.C.2, quoting reference 725A. (C 349)

FUSEGEAR TECHNICAL REPRESENTATIVES. Immediate openings are available with the English Electric Co., Ltd. Applicants must have a Higher National Certificate (Electrical) and practical engineering experience or training.—Please write, giving full details and quoting Ref. 1073, to Central Personnel Services, English Electric Co., Ltd., 336-7 Strand, London W.C.2. (C 314)

JOHNSON & PHILLIPS require a DRAUGHTSMAN for their Capacitor Department. Preference will be given to applicants having experience in capacitor work. —Applicants should be between the age of 22 and 26, and should state age, training, experience and salary required in writing to Employment & Welfare Manager, Johnson & Phillips, Ltd., Victoria Works, Charlton, S.E.7. (C 283)

DE HAVILLAND

Advanced Guided Weapon · Projects

Technicians are needed for key positions in an expanding team engaged on research, design and development work. Permanent and progressive posts, both senior and junior, are available for men of ability and enthusiasm who can offer sound knowledge and experience. This is a unique opportunity of acquiring advanced techniques and promotion prospects are good.

Reference:

17 DESIGNERS experienced in servo mechanisms, gyros, hydraulics, pneumatics, materials and structures related to aircraft or armament work.

17A DRAUGHTSMEN—SENIOR, INTERMEDIATE and JUNIOR for varied aspects of design.

18 MATHEMATICIAN for work on control systems. Knowledge statistics and noise. First-class honours or higher degree.

19 PHYSICISTS—SENIOR—for research team. With honours degree and industrial experience.

20 PHYSICISTS as research workers for field and laboratory tests, with good degree and some industrial experience in electronics or specialising in mathematics.

21 ELECTRONIC ENGINEERS — SENIOR — to be responsible for section engaged in work as reference 22 below.

22 ELECTRONIC ENGINEERS experienced in one or more of following—circuit development, miniature and sub-miniature techniques, magnetic amplifiers and equipment.

23 DEVELOPMENT ENGINEERS, H.N.C. standard, experienced structural testing (preferably aircraft), knowledge of strain-gauge equipment an advantage. Capable of working on own initiative planning test equipment and analysing test results.

24 DEVELOPMENT ENGINEERS, H.N.C. standard, familiar small electro-mechanical equipment, pneumatic and hydraulic servo systems for testing and developing. Knowledge electronic test equipment a distinct advantage. Should have experience in undertaking planning, carrying out and analysing of complete tasks.

26 INSTRUMENT ENGINEERS—experience of electro-mechanical instruments (gyros, small specialised motors, relays, etc.).

27 SERVO ENGINEERS—practical experience of servo mechanisms.

28 LABORATORY ASSISTANTS, qualified H.N.C. City and Guilds standard, for varied work.

29 WIREMEN—advanced laboratory standard.

30 WIREMEN—familiar circuit diagrams, radio or radar maintenance experience. Young ex-Servicemen particularly invited to apply.

31 TRIALS ASSISTANT—experience as reference 30 above.

Apply in confidence quoting reference number of post in which interested to:

The Personnel Manager,

DE HAVILLAND PROPELLERS LTD.

Hatfield · Hertfordshire.

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

JUNIOR ENGINEER ESTIMATOR wanted by well-known West End electrical contractors.—Write in first instance, stating age, experience and salary required. Box No. 2311, Electrical Times. (C 363)

LONDON TRANSFORMER PRODUCTS LTD., Bridgend, Glamorgan, require an experienced DRAUGHTSMAN fully conversant with the manufacture of power transformers up to 2,500 kVA, 33 kV. A modern house can be made available for a successful married applicant. —Reply, giving full details of age, experience and salary required, to "The Chief Draughtsman." (C 365)

MAINTENANCE ELECTRICIAN required by Frigidaire. All-round experience of resistance welding equipment essential.—Call, phone or write, Personnel, Stag Lane, N.W.9 (Colindale 6541). (C 399)

MECHANICAL MAINTENANCE ENGINEER wanted for large industrial power plant equipped with h.p. water-tube boilers, turbines and modern auxiliaries. Applicants must have some years' practical experience with this type of power plant backed up with technical knowledge up to H.N.C. standard or its equivalent. Age not less than 32 or more than 45. Non-contributory pension scheme. Commencing salary £950. Position offers good prospects for a suitable man.—Reply to Box No. 2323, Electrical Times, quoting reference TME 4. (C 396)

OPPORTUNITIES available to young men with good university degrees. Applicants, preferably with some industrial experience, but must have aptitude to eventually assume responsible posts in one of the many spheres associated with growing switchgear manufacturing organisation.—Full particulars of past experience, qualifications, etc., to Box No. 2327, Electrical Times. (C 406)

PAKISTAN. Applications, preferably from single men, aged 28-40 years, are invited by an old-established cable company, for a position of MANAGER AND ENGINEER of their local selling company in Karachi. Duties will include periodic visits to the company's agents in India to give collaborative assistance. Applicants should be suitably qualified by technical training and have electrical engineering experience, which must include transmission and distribution. Initiative for sales development and some commercial knowledge required. —Details of qualifications, experience and salary expected to Box No. 2329, Electrical Times. (C 407)

PROFESSIONAL ENGINEERS IN VARIOUS GOVERNMENT DEPARTMENTS. The Civil Service Commissioners invite applications for about 150 pensionable posts in a wide variety of engineering duties. Applications may be accepted up to September 30, 1953, but an earlier closing date may be announced.

Candidates must be under 35 on January 1, 1953, with extension for regular service in H.M. Forces and up to two years for permanent civil service. For the Post Office they must be at least 21, for the Ministry of Supply and Ministry of Civil Aviation at least 23, and for all other departments at least 25 on that date.

Generally a candidate must possess a university degree in engineering or be a corporate member of one of the professional institutions, mechanical engineers, electrical engineers or civil engineers or have passes in, or exemption from, Sections A and B of the corresponding associate membership examinations. Exceptionally, candidates of high professional attainment, but without the specified qualifications, may be admitted. For some posts associate fellowship of the Royal Aeronautical Society or an honours degree in physics will be accepted.

Inclusive salary scale (men in London) £628 (at age 25) to £970. Starting salary according to age up to £875 at 34. Candidates entering below age 25 will start at salaries varying from £429 at age 21 to £549 at age 24. Prospects of promotion. Salaries of next higher grades are £970-£1,230 and £1,331-£1,536. Somewhat lower for women and in the provinces.

Further particulars and application forms from Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London W.1, quoting No. S85/53. (C 379)

REPRESENTATIVE required. Kent area. Must be an experienced man, electrical.—Kettle, Knightrider Street, Maidstone, Kent. (C 376)

REVO ELECTRIC CO., LTD., require a REPRESENTATIVE with previous sales experience with manufacturers for the sale of cookers, street lighting equipment, appliances, and industrial fittings, for the Essex, Hertfordshire, North London, and a small part of Bedfordshire and Buckinghamshire, area. Resident in area and car owner. 30 Gt. Queen Street, London W.C.2. (C 397)

RESEARCH. A. Reyrolle and Co., Ltd., have vacancies for ELECTRICAL ENGINEERS and PHYSICISTS to be engaged on the various aspects of research in connection with the development and performance of h.v. and e.h.v. switchgear, including circuit breaking, insulation, system conditions protection and instrumentation. Applicants should be graduates of a British University, preferably with an honours degree, and while previous experience on similar type of work would be an advantage, graduates with the required technical knowledge only may be selected for training. Salaries according to age and experience. Excellent working conditions with modern, fully equipped laboratories; superannuation scheme.—Applications, which will be treated in the strictest confidence, to be submitted with full particulars to the Chief Engineer, A. Reyrolle and Co., Ltd., Hebburn, Co. Durham. (C 234)

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SENIOR ELECTRICAL DESIGNER required by expanding company in Scotland. Experienced in automatic control gear details and their application, and with a knowledge of design for production. This is a post for an outstanding man who is not afraid of responsibility and will carry a salary commensurate with experience and capacity. Arrangements may be made in respect of accommodation, should this be necessary.—Apply in confidence, giving full particulars and indicating salary expected, to Box No. 2331, Electrical Times. (C 408)

TECHNICAL SALES CORRESPONDENTS are required by Sangamo Weston Ltd. in their Weston Instrument Section. Applicants should preferably have had previous engineering and commercial experience in connection with electrical measuring instruments, but those similarly employed in some other branch of the light electrical engineering industry will be considered. Age desirably 25-35 years. These positions offer plenty of scope for men who are technically qualified and who also have a real interest in the commercial side of "sales."—Applications, all of which will be acknowledged, should be addressed to The Employment Manager at Gt. Cambridge Road, Enfield, Middlesex. (C 395)

THE NATIONAL BOILER AND GENERAL INSURANCE CO., LTD., St. Mary's Parsonage, Manchester 3, require ENGINEERS for appointment as Inspecting Engineers of (a) Boilers and Engines; (b) Lifts and Cranes; and (c) Electrical Plant. First-class M.o.T. Certificate of Competency, and/or Higher National Certificate (Mechanical or Electrical), full apprenticeship and practical experience necessary.—Apply in own handwriting, giving age (limits 26 to 33), training and experience, academic qualifications and copies of testimonials. Salary up to £750 per annum. Non-contributory pension scheme. (C 322)

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IT IS DESIRED to secure the full commercial development in the United Kingdom of British Patent No. 615,238, which relates to "ELECTRICAL HEATERS AND METHOD OF MAKING THE SAME," either by way of the grant of licences or otherwise on terms acceptable to the Patentee. Interested parties desiring copies of the patent specifications should apply to Stevens, Langner, Parry and Rollinson, 5 to 9 Quality Court, Chancery Lane, London W.C.2. (C 402)

THE PROPRIETOR of British Patents Nos. 611697 and 611698 entitled "ELECTROMAGNETIC RELAY" and "ELECTROMAGNETIC RELAY" respectively, offers same for licence or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern and Carlberg, 14 East Jackson Boulevard, Chicago 4, Illinois, U.S.A. (C 356)

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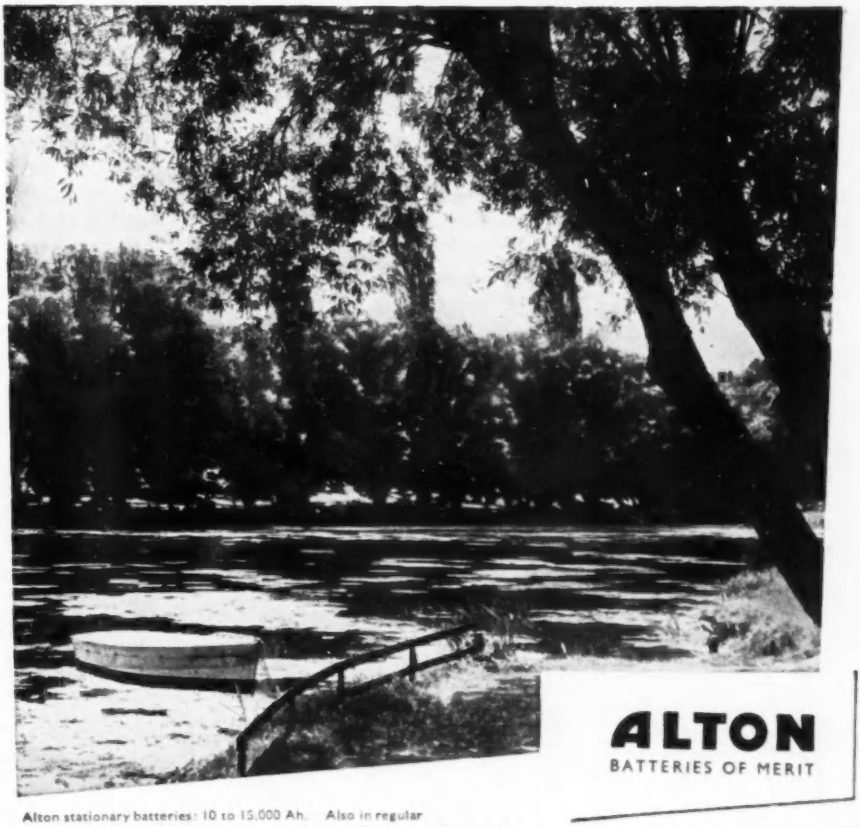

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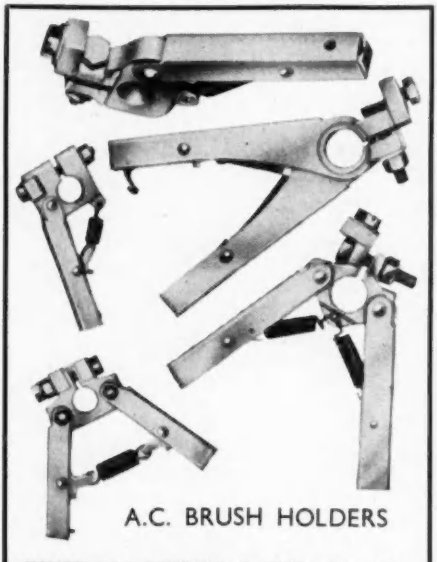

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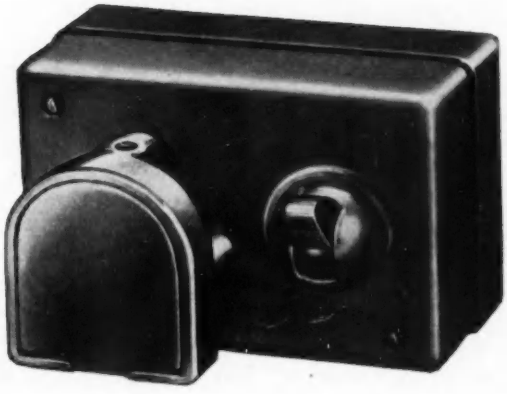

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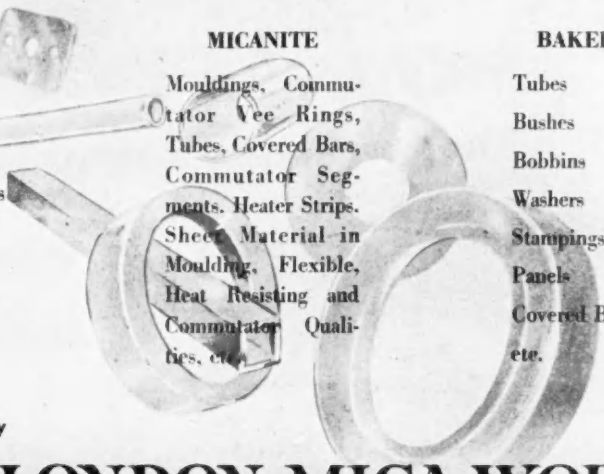

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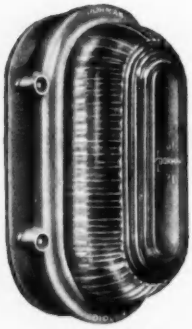

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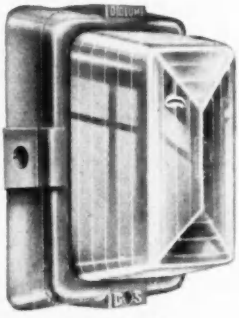

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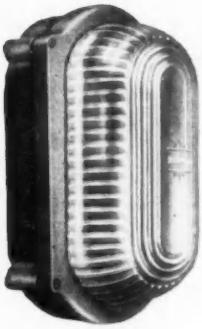

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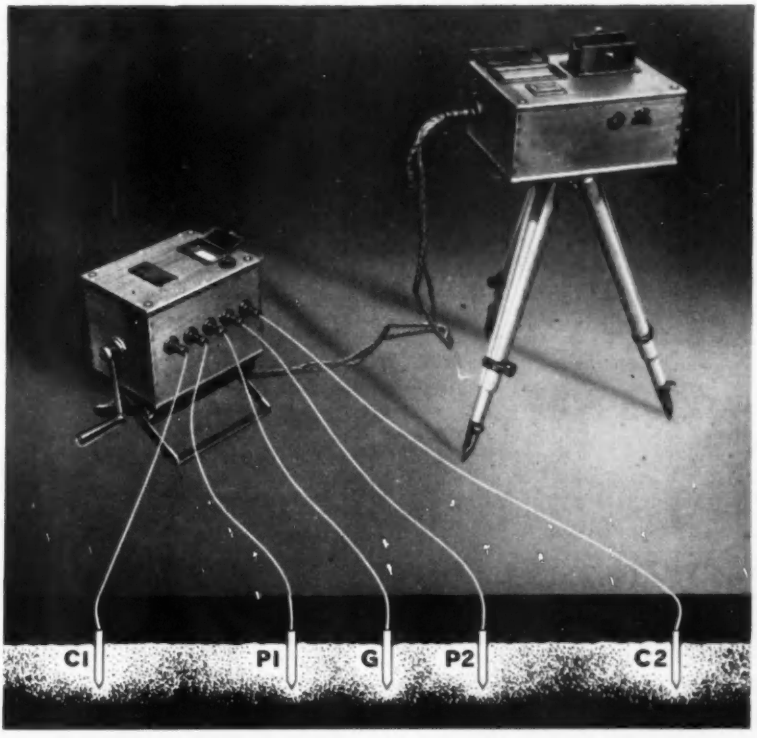

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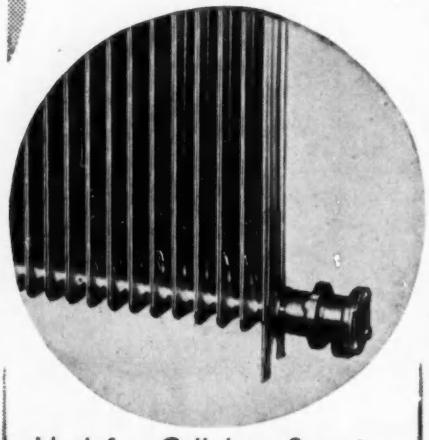

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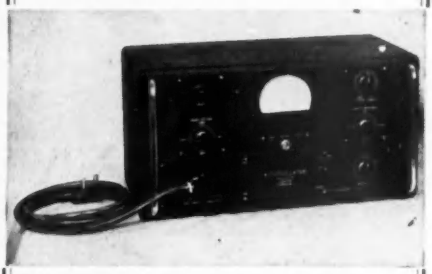

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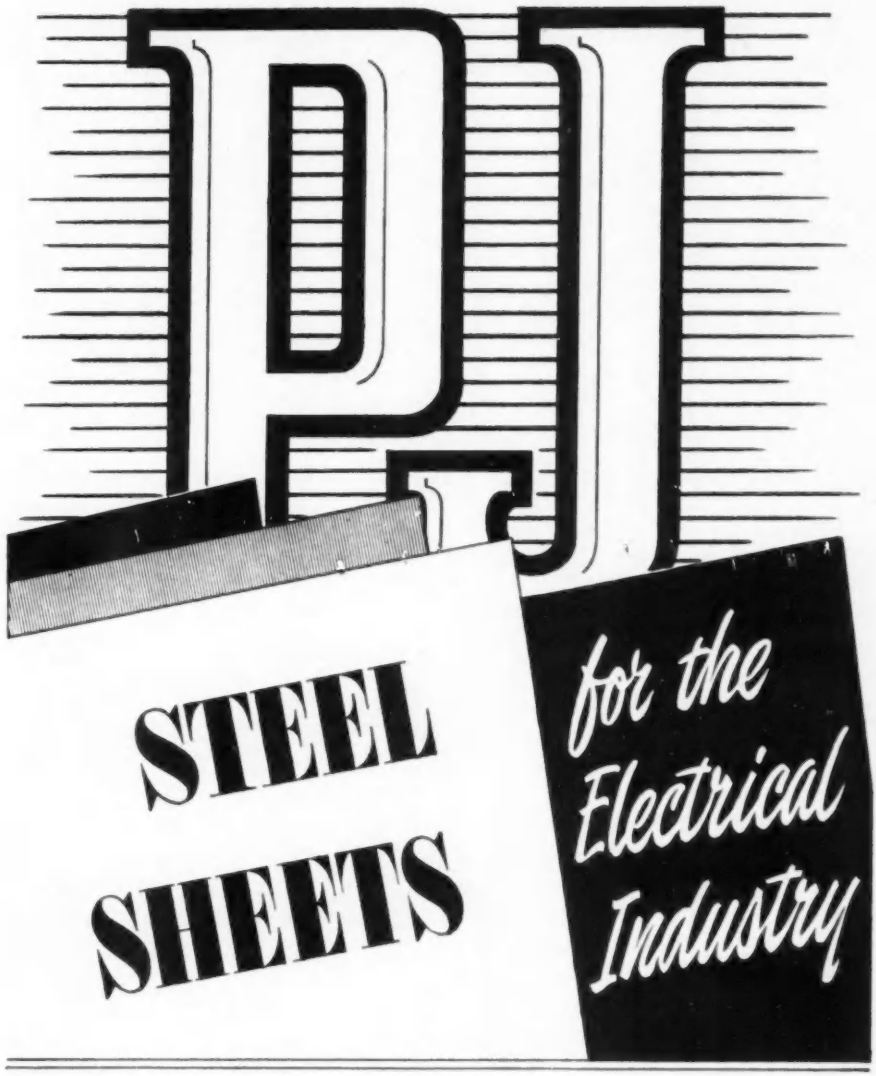

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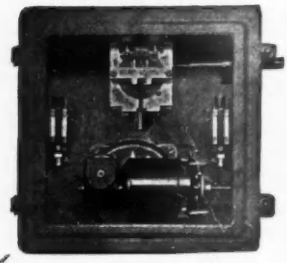

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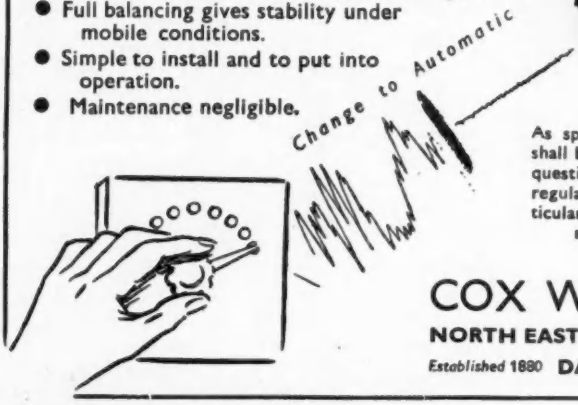

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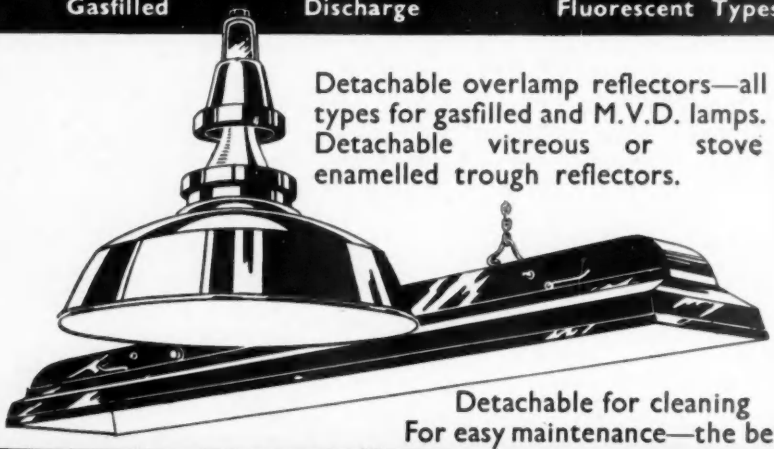

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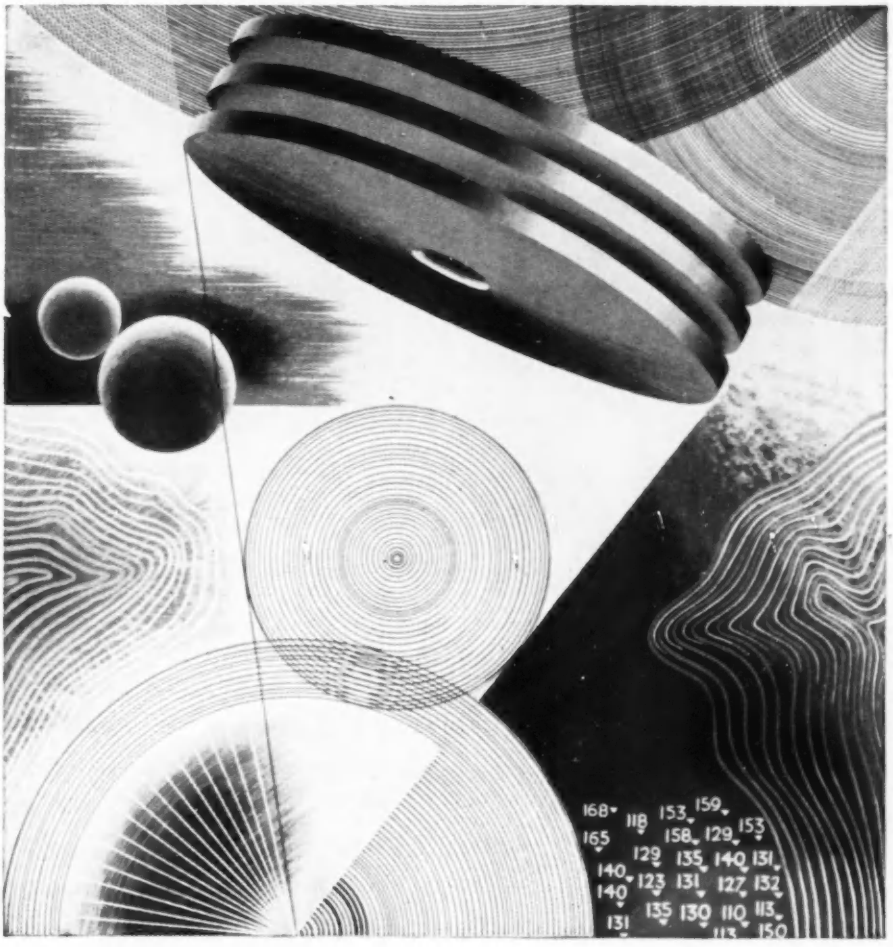

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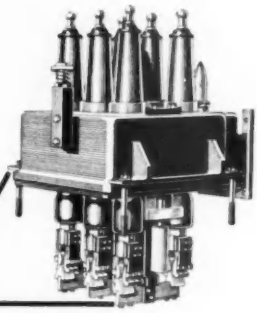

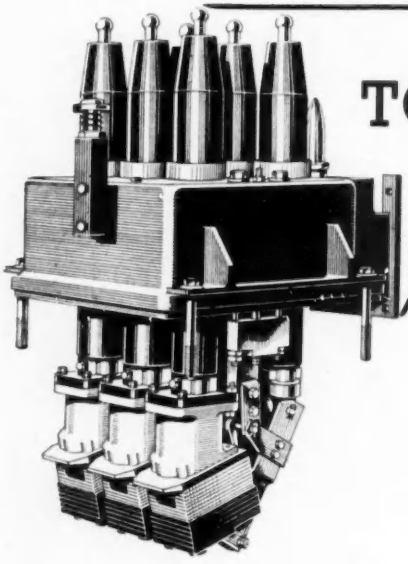

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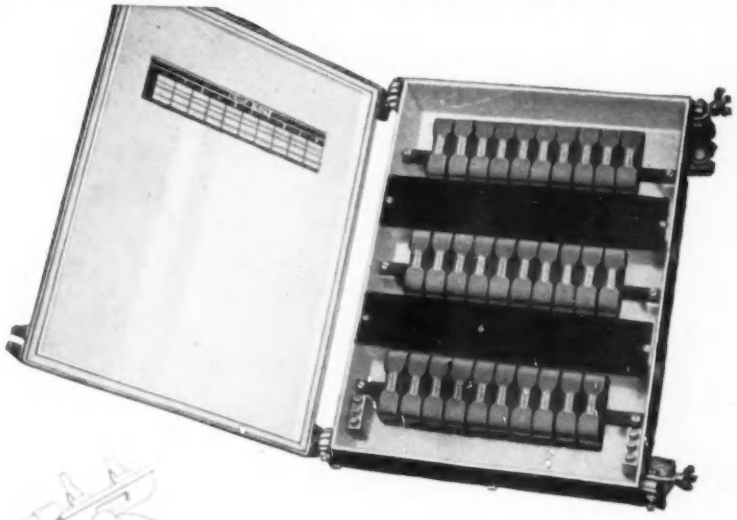

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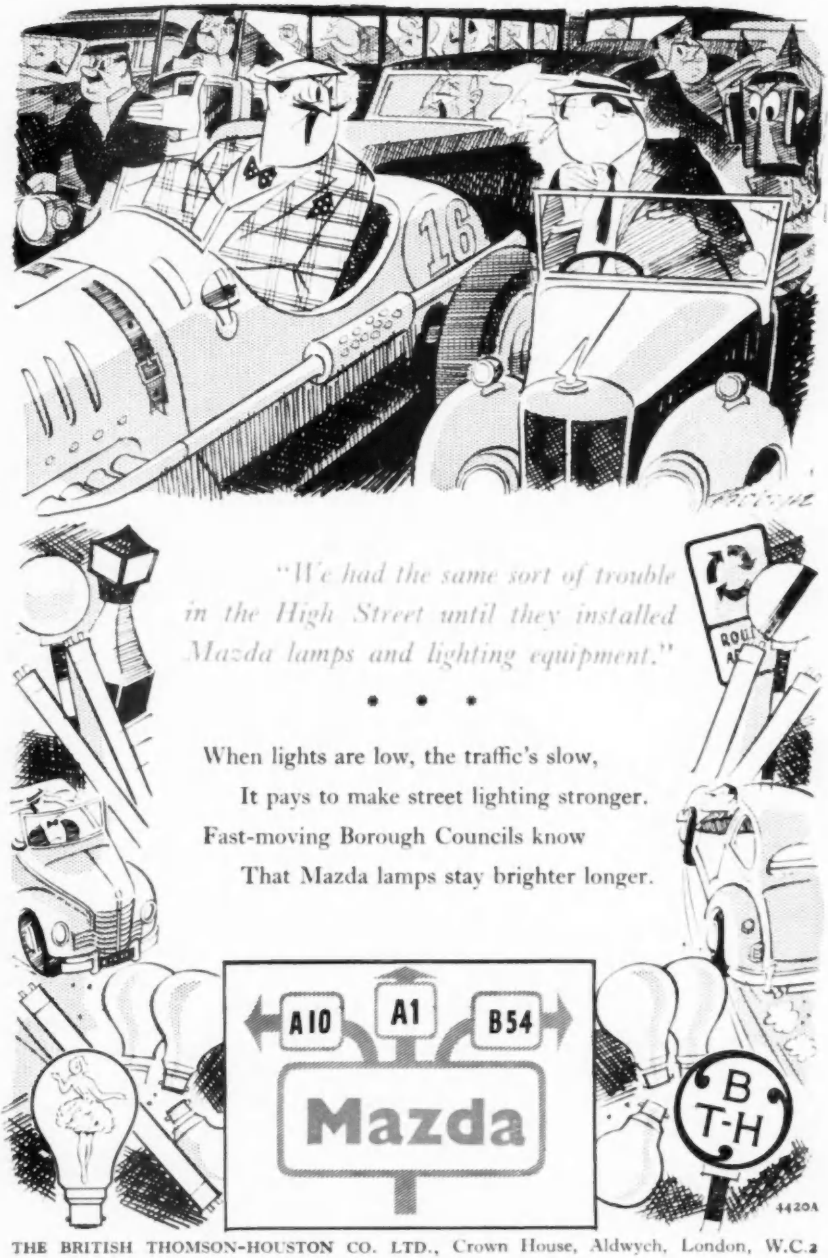

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